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BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI

Editat de
UNIVERSITATEA TEHNICĂ „GH. ASACHI", IAŞI

Tomul XLIV (XLVIII)

Fasc. 1 - 2

Secţia VIII

TEXTILE. PIELĂRIE

1998

ORSZÁGOS MŰSZAKI INFORMÁCIÓS KÖZPONTI KÖNYVTÁR 1983

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI

Tomul XLIV (XLVIII)
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BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
BULLETIN OF THE POLYTECHNIC INSTITUTE OF JASSY
Tomul XLIV (XLVIII), Fasc. 1–2 1998

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TEXTILE. PIELĂRIE

L'ACTION DU FURFURAL SUR LA LAINE

PAR
SAVEL IFRIM

Knowing that the aldehydes have the property to reticulate the wool keratin and that the furfural has chemical behaviours similarly to the formaldehyde, in this paper the furfural action concerning the wool is investigated.

The appeared modifications in the treated wool with furfural, by the urea-disulphite and alkali solubility tests are pursued and also by the physico-mechanical indices determinations, as for instance the resistance to tearing, extension and the swelling of wool fibres too.

The experimental results prove that the treated wool with furfural has a smaller solubility in urea-disulphite and alkali, than the witness sample; the resistance to tearing of the treated fibres increases, but the extension and the swelling diminish.

All these modifications permit to conclude that by wool treatment with furfural new cross-linkings are formed in keratin, so that the wool fibre is consolidated.

1. Introduction. Les propriétés caractéristiques de la laine lui confèrent une importance particulière pour l'industrie textile. Mais la laine manifeste également quelques insuffisance dans la pratique, à savoir: supercontraction, résistance diminuée par rapport aux agents alcalins, feutrage, etc.

Les opérations de finissage textile ont le but d'améliorer ou bien d'éloigner les défauts de cette matière première textile. Une telle opération qui est fréquemment appliquée aux tissus de laine, c'est le fixage. On poursuit par cette opération la réalisation de dimensions stables pour la fibre de laine.

La stabilité des dimensions, c'est-à-dire le fixage, peut être réalisée par différents procédés chimiques, qui déterminent la formation de nouvelles liaisons transversalles dans la kératine de la laine. L'apparition de ces liaisons attribue à la laine, ôté la stabilité des dimensions, un certain grade d'insolubilité dans les réactifs spécifiques, l'augmentation de la résistance mécanique et la diminution de l'extension de la fibre.

La réactivité relativement élevée de la kératine, déterminée par les groupements fonctionnels libres se trouvant dans sa structure chimique, favorise l'apparition de plusieurs possibilités pour sa réticulation. Parmi ces possibilités, la réticulation de la kératine à l'aide des composés organiques et surtout avec les aldéhydes est la plus utilisée et la plus étudiée.

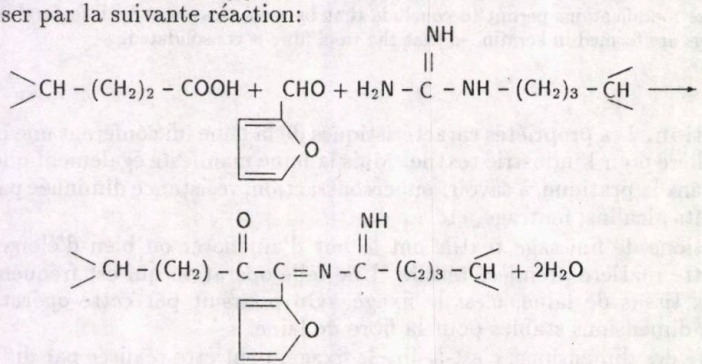
Dans la littérature de spécialité il n'y a pas signalée l'utilisation du furfural comme agent réticulant de la kératine.

Le but du ce travail est de mettre en évidence l'action du furfural sur la laine, cherchée par la détermination de la solubilité de celui-ci dans l'urée–bisulfite et dans la solution d'hydroxyde de sodium $n/10$, ainsi que par la détermination des indices physico-mécaniques de la fibre.

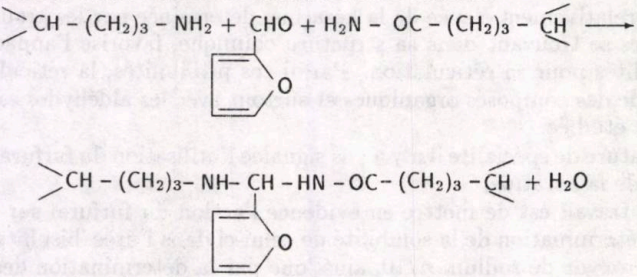
2. Partie théorique. L'action des aldéhydes sur la laine a été bien cherchée, mais une attention particulière on a accordé seulement à l'aldéhyde formique. Cet aldéhyde peut former nouveaux ponts transversaux dans la kératine, en réagissant avec les groupements aminiques et amidiques [1], avec les groupements carboxyliques et alcooliques [2], inclusivement avec le noyau aromatique de la thyrosine [3]. De même peuvent être impliqués dans lese réactions de réticulation le reste de guanidine de l'arginine, de groupements peptidiques par leur atoms d'hydrogène, ainsi que le groupement thiolique de la cysteine [4]. Par conséquent, il y a une grande variété de possibilités afin d'introduire de nouvelles liaisons transversalles dans la structure de la kératine et de consolider la structure de la fibre de laine à l'aide des aldéhydes [5], [6].

Le furfural manifeste de propriétés chimiques pareilles aux aldéhydes aromatiques; il peut participer, par son groupement aldéhydique, aux nombreux réactions de condensation [7] et parfois il se comporte comme l'aldéhyde formique. On peut donc considérer que les groupements fonctionnels libres de la kératine peuvent participer aussi à la réaction de condensation avec le groupement aldéhydique du furfural.

Prenant en considération le fait que le furfural réagit avec le groupement carboxylique du reste de l'acide glutamique et avec le groupement aminique de l'arginine, ainsi que l'aldéhyde formique [2], la nouvelle liaison transversalle qui se fait peut être schématiser par la suivante réaction:



Dans le cas que pendant le processus de condensation participe le groupement aminique du reste de l'ornithine et le groupement amidique du reste de glutamine, la nouvelle liaison transversalle se forme selon le schéma:



De cette manière on peut représenter de nouvelles liaisons transversalles, en impliquant de groupements aminiques et l'hydrogène lié à l'atome d'azote du groupement peptidique, de groupement hydroxyliques et thioliques, ainsi que les noyaux aromatiques [3].

La fraction de la kératine riche en soufre peut être réticulée par la participation à la réaction avec le furfural du groupement thiolique exclusif, ou en même temps avec un groupement soit entre deux atomes de soufre, soit entre un atome de soufre et un atome d'azote [4].

La réaction de condensation de la kératine avec le furfural et également avec les autres aldéhydes est favorisés par les régions amorphes de la fibre, puisque dans ces régions le pourcentage de lysine, thyrosine, acides aspartique et glutamique est plus élevé [8]. Mais la molécule du furfural est assez petite de sorte qu'elle peut pénétrer aussi dans les régions fibrillaires de la kératine.

Par la formation de nouvelles liaisons transversalles, la solubilité de la laine dans le réactif urée–disulfite [9], [10] et dans la solution alcaline [11] abaisse et les indices physico-mécaniques se modifient. Pratiquement, la résistance de rupture augmente, tandis que l'extension et le gonflement de la fibre diminuent.

3. Partie expérimentale. La purification de la laine s'est fait par extraction avec tétrachlorure de carbone dans l'appareil Soxhlet, ensuite on l-a lavé avec de l'eau chaude, ayant la température 35-38°C. Les impurités végétaux ou d'autre nature ont été éloignées manuellement et on l-a lavé encore une fois avec tétrachlorure de carbone.

On a traité des épreuves de laine purifiée avec une solution aqueuse de 1% furfural (le furfural a été toujours frais distillé) à l'ébullition, en utilisant un hydromodul de 1/50, pendant 30 minutes; les autres épreuves ont été traitées identiquement, mais pour une durée de 90 minutes. Puis les épreuves de laine ont été lavées avec beaucoup de l'eau distillée et laissées à la température de la chambre pour séchage.

Après ce traitement, la laine apparaît colorée en jaune, coloration qui s'intensifie avec l'augmentation de la durée de traitement.

On a traité des autres echantillons de laine dans une solution 1% furfural en pyridine, les conditions de travail étant les mêmes indiquées plus haut. Dans ce cas aussi la laine a été colorée en jaune.

Les modifications physico-mécaniques et chimiques apparues dans la fibre de laine ont été mises en évidence par l'utilisation des tests de solubilité dans le réactif urée–disulfite et dans la solution d'hydroxyde de sodium 0,1 n.

La solubilité dans l'urée–disulfite a été déterminée selon la méthode de L e s s et E l s w o r t h [9], [10], pendant que la solubilité dans l'alcali a été testée à l'aide de la méthode de H a r r i s et S m i t h [11]. Parallèlement on a fait toujours aussi des épreuves témoins. Les résultats de ces déterminations sont présentés dans le Tableau 1. Chaque donnée de ce tableau représente la moyenne de dix déterminations.

On a déterminé aussi les indices physico-mécaniques, respectivement la résistance de rupture des fibres, l'extension et leur diamètre.

On a fait les déterminations de la résistance de rupture et de l'extension à l'aide d'un dynamomètre pour fibres type Schoper. La distance entre les pinces de l'appareil a été toujours la même, respectivement 20 mm. Pour chaque épreuve de laine on a fait cent déterminations. La résistance de rupture (F) est calculée en utilisant la

Tableau 1

No. crt.	L'épreuve de laine	La solubilité dans	
		L'urée–disulfite %	Hydroxyde de sodium %
1	L'épreuve témoin	23,45	23,12
	Laine traitée avec du furfural en solution aqueuse		
2	30 minutes	16,81	21,10
3	90 minutes	14,23	20,76
	Laine traitée avec du furfural en pyridine		
4	30 minutes	18,80	21,35
5	90 minutes	16,98	20,64

relation suivante:

$$F = 0,5 + \frac{XG}{100}, \text{ [gf/fibre]},$$

tandis que l'extension (E) a été calculée à l'aide de la relation:

$$E = 100\frac{X}{L}.$$

Dans ces relations X représente la moyenne des cent déterminations, G représente le poids du pendule, étant toujours 20 grammes et L signifie la distance entre les deux pinces du dynamomètre, respectivement la longueur de la fibre expérimentée, qui a été 20 mm. Les résultats obtenus sont présentés dans le Tableau 2.

Tableau 2

No. crt.	L'épreuve de laine	Résistance de rupture, [gf/fibre]	L'extension %	Diamètre micromètres
1	L'épreuve temoin	4,71	40,63	23,91
	Laine traitée avec du furfural en solution aqueuse			
2	30 minutes	5,16	36,71	20,44
3	90 minutes	5,47	34,43	19,40
	Laine traitée avec du furfural en pyridine			
4	30 minutes	5,35	34,46	20,00
5	90 minutes	5,84	32,39	17,50

Afin de déterminer le diamètre des fibres, on a soumis au processus de gonflement dans les solutions de carbonate de sodium, ayant le pH=10, les épreuves de laine traitée et également l'épreuve temoin et elles ont été mentenues là pendant 12 heures. On a déterminé le diamètre des fibres à l'aide d'un lanamètre type Carl Zeiss Jena, en faisant plus que 50 lectures. La moyenne de ces lectures est présentée de même dans le Tableau 2.

4. Interprétation des résultats. L'apparition de la coloration jaune de la laine traitée avec du furfural peut être expliquée premièrement par la présence de la molécule de furfural liée par liaisons covalentes à la kératine, puisque cette molécule

est colorée en jaune claire. En même temps, la coloration de la laine peut être expliquée par la formation des structures chromophores dans la kératine. Vraiment, par l'observation du mécanisme chimique de réticulation de la kératine avec du furfural, auquel participe un groupement carboxylique et un groupement aminique de l'arginine, il se fait un système formé de plusieurs doubles liaisons conjuguées, système chromophorique qui génére la coloration de la fibre.

La présence d'une groupement carbonylique dans ce système amplifie son action chromophorique; donc, l'apparition de la coloration de la laine peut être scientifiquement expliquée.

Par l'analyse des indices de solubilité (Tableau 1) on observe sans difficulté que tant la solubilité dans l'urée–disulfite ainsi que dans l'alcali est plus petite dans le cas de la laine traitée que dans le cas de l'épreuve temoin. Par la prolongation du temps de traitement de la laine avec du furfural, la solubilité dans les réactifs mentionnés, abaisse encore plus. Cette diminution de la solubilité ne peut pas être expliquée que par la formation de nouvelles liaisons transversalles entre les chaînes polypeptidiques de la kératine.

La formation de ces ponts transversaux et donc la réticulation de la kératine explique également l'augmentation de la résistance de rupture de la fibre traitée avec du furfural, ainsi comme attestent les données expérimentales de Tableau 2. En même temps, la formation des nouveaux ponts transversaux empêche le glissement réciproque des chaînes polypeptidiques, de sorte que l'extension de la fibre est bien diminué. Cette interprétation est confirmée par les indices qui reflétent l'extension de la fibre traitée avec du furfural, par rapport aux fibres de laine nontraitée. Aussi, les indices qui expriment l'extension de la fibre abaissent avec la prolongation du temps de traitement de la laine avec du furfural; cet abaissement confirme la formation d'un plus grand nombre de nouvelles liaisons transversalles dans la kératine.

Les données qui reflétent la variation du diamètre des fibres (Tableau 2) démontrent que ce diamètre est bien plus petit dans le cas des fibres traitées, comparativement au diamètre des fibres de l'épreuve temoin. Dans ce cas aussi le diamètre des fibres traitées pur une durée plus longue est encore plus petit que le diamètre des fibres traitées seulement 30 minutes.

Il est bien connu le fait que par l'introduction de nouvelles liaisons transversalles le gonflement de la fibre est empêchée et par conséquence son diamètre est plus petit. Cettes données confirment de même la formation de nouvelles liaisons transversalles dans la kératine, pendant le traitement de la laine avec du furfural.

Il y a une parfaite concordance concernant les tests de solubilité et les indices physico-mécaniques; vraiment, toutes les données expérimentales permettent de tirer la même conclusion, à savoir: par le traitement de la laine avec du furfural se font de nouveaux ponts transversaux dans la kératine, de sorte que la fibre de laine résulte plus consolidée.

Le traitement de la laine avec la solution de furfural en pyridine ne détermine que dans une petite mesure la formation d'un nombre plus grand de liaisons transversalles dans la kératine. Cet aspect peut être déduit à l'aide des indices de solubilité dans l'urée–disulfite et ces qui reflètent l'extension et le gonflement de la fibre. On peut donc afirmer que la pyridine favorise en petit mesure la réaction du furfural avec les groupements libres de la kératine.

Le processus de traitement de la laine avec du furfural se réalise facilement et il ne nécessite pas de substances auxiliaires.

5. Conclusions. On fait dans ce travail une étude de l'action du furfural sur la laine, en considérant le fait que les aldéhydes manifestent la propriété de réticuler la kératine et que le furfural se comporte ressemblant à l'aldéhyde formique.

Les modifications apparues dans la fibre de laine traitée ont été mises en évidence à l'aide des tests de solubilité dans l'urée–disulfite et dans l'alcali, ainsi que par la détermination des quelques indices physico-mécaniques, à savoir: la résistance de rupture de la fibre, l'extension et la variation du diamètre des fibres soumises au processus de gonflement.

Les données expérimentales obtenues démontrent que la laine traitée avec du furfural a la solubilité dans l'urée–disulfite et dans l'alcali plus petite. Les indices physico-mécaniques attestent que par le traitement de la laine avec du furfural, la résistance de rupture de la fibre augmente, tandis que l'extension abaisse. En même temps, la fibre de laine traitée avec du furfural se gonfle moins que la fibre nontraitée.

Toutes les données expérimentales permetent de tirer la conclusion que par traitement de la laine avec du furfural s'établissent de nouvelles liaisons transversalles dans la kératine et que la fibre se consolide.

Reçue le 28 jouillet 1997

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Chaire de Chimie générale

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ACŢIUNEA FURFUROLULUI ASUPRA LÂNII

(Rezumat)

Cunoscând faptul că aldehidele au proprietatea de a reticula cheratina lânii şi că furfurolul se comportă din punct de vedere chimic asemănător aldehidei formice, se cercetează acţiunea furfurolului asupra lânii, în scopul consolidării fibrei.

Modificările apărute în lâna tratată cu furfurol au fost urmărite prin teste de solubilitate în uree–disulfit şi în alcalii, cât şi prin determinări ale unor indici fizico-mecanici ca rezistenţa la rupere, alungirea şi variaţia diametrului fibrelor supuse umflării.

Datele experimentale arată că lâna tratată cu furfurol are solubilitatea în uree–disulfit şi în alcalii mai mică decât proba martor; rezistenţa la rupere a fibrei tratate creşte, iar alungirea şi umflarea scad. Toate aceste modificări duc la interpretarea că prin tratarea lânii cu furfurol se formează noi legături transversale în cheratină, încât fibra de lână se consolidează.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

SUPERMOLECULAR STRUCTURE OF POLYMER SOLIDS AND ITS EFFECTS ON PENETRANT TRANSPORT

BY

V. BLAŞCU

Studies of the correlation of penetrant transport and the conditions of preparation of the solid polymer have been carried out rigorously. These studies connects phenomena with causal sequence.

1. Introduction. The penetration of small molecules into a polymer, solid or liquid, frequently plays an important role in industrial processes such as the spinning and finishing processes in fiber manufacturing and the casting and finishing processes in membrane manufacturing. The kind of solvent molecules used in solidifying a polymer through coagulation influences the supermolecular structure of the finished polymer solids. For example, acetone, which is employed for the coagulation of a solution of polyparaphenylene terephthalamide film and cuprammonium-regenerated cellulose hollow fiber works so as to orient the hydroxy group in the direction parallel to the surface plane of a film or a fiber, whereas water would orient it in the direction perpendicular to plane [1], [2].

Studies of the correlation of penetrant transport and the conditions of preparation of the solid polymer have been carried out rigorously, and some empirical equations for the ideal manufacturing procedure have been proposed in the field of fibers technologies [3],...,[5].

2. General Description of Supermolecular Structure of Polymer Solids. Fig. 1 shows a schematic representation of the relationship between supermolecular structure and the mechanisms of penetrant transport through the polymer solid. The arrow shown by a full line indicates the flow of a penetrant with a single flow mechanism as denoted, and the broken line indicates the actual general penetrant transport. Because the transport of the penetrant occurs mainly from the environmental liquid or gas to the inside of the polymer solid, a higher order structural factor always contributes to the transport. When the penetrant molecule is small, the rate-determined region of transport is related to the lower order structural factor.

In the case of viscous flow, the coagulation structure (the fourth structural factor) dominates penetrant transport and is almost independent of other factors. In the actual case of penetrant transport the complex situation shown by the broken line in Fig. 1 may occur, and the contribution of each factor to the transport may change from case to case.

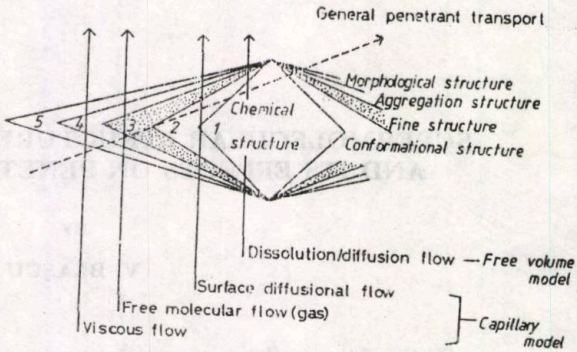

Fig. 1.– Schematic representation of relationship between supermolecular structure and penetrant transport through the polymer solid. The numbers indicate the order of the structural factor. The area crossed by the full-line arrow denoted by the flow mechanism indicates the contribution of that structural factor to the flow mechanism.

Table 1

Definition of Supramolecular Structure and Methods of Evaluating It

Structural order	Target size, [nm]	Structure description	Evaluation methods[a)]
First (chemical structure of monomer)	0.1...1.0	Chemical structure, molecular weight and its distribution, configuration and tacticity, composition of copolymer and blend and its distribution	Spectrometry (NMR, IR, UV, vis, MS), chromatography (LC, GPC, TLC) light scattering, viscometry
Second (conformation)	1...10	Conformation, local chain orientation, crystal structure, amorphous structure	NMR, IR, LS, diffractometry (X-ray, electron), CD, ORD, EM, AFM
Third (fine structure)	10...10^2	Orientation (chain, axis, crystal plane), interfacial structure, crystal size, crystallinity, crystal perfection, molecular packing (density, regularity), lateral order	NMR (broad-line), IR, LS (small-angle), X-ray diffraction, EM (SEM, TEM), optical microscopy, thermal analysis (DTA, DSC), viscoelastometry (dynamic, static) refractometry
Fourth (aggregation structure)	10^2...10^4	Aggregation structure (particle size, porosity, degree of amalgamation), fibril and microfibril (size, length, orientation), microvoid, pore structure (pore size and its distribution, pore shape, porosity)	Electron microscopy, optical microscopy, viscoelastometry, permeability, porosimetry, adsorption isothermometry
Fifth	10^4...10^6	Shape of membrane (plahollow fiber), symmetrical and asymmetrical membrane, complex membrane, dynamic membrane, liquid membrane	Optical microscopy, light scattering

[a)] NMR – Nuclear magnetic resonance, IR – infrared, UV – ultraviolet, vis – visible, MS – mass spectrometry. LC – liquid chromatography, GPC – gel permeation chromatography, TLC – thin layer chromatography, LS – light scattering, CD – circular dichroism, ORD – optical rotary dispersion, EM – electron microscopy, AFM – atomic force microscopy, SEM – scanning EM, TEM – transmission EM, DTA – differential thermal analysis, DSC – differential scanning calorimetry.

Table 1 summarizes the classification of supermolecular structure and lists the characterization methods for the various structural orders. A first-order structural factor can be mainly evaluated through resonance-type spectrometries such as infrared or nuclear magnetic resonance spectrometry. The second can be evaluated through diffraction methods such as X-ray and/or electron diffraction and through resonance spectroscopy. The third structural factor can be characterized mainly through electron microscopy and relaxation absorption, and the fourth through optical microscopy and/or methods of interfacial phenomena such as mercury intrusion porosimetry.

3. Structural Characteristic of Polymer Solids. The penetrants permeate into a polymer solid through the pores (capillary model) and/or through the free volume (free-volume model). The difference between models exists because of the assumption that pores may exist in the solid. The pores play the main role in transport in the capillary model and are neglected in the case of free-volume model. In the latter model the fine structure of the amorphous region, where the polymer segments frequently jump from their equilibrium positions to adjacent holes that generate by the random thermal motion of the segments at temperatures above the glass transition temperature, T_g, determines the transport.

Fig. 2 illustrates the structural features of both models and their peculiarities. In the capillary model the contribution of the chemical structure is taken into account by the adsorption and/or solubility coefficient of the penetrant in the polymer solid.

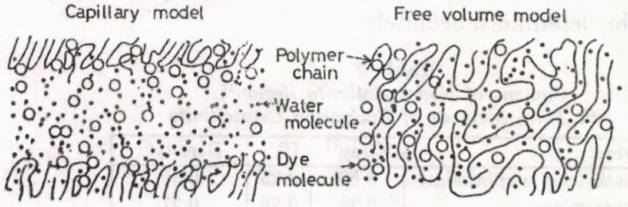

Fig. 2.– Comparison between capillary model and free-volume model from the view-point of dye uptake. The small dots stand for water molecules, the open circles are dye molecules and the full lines stand for polymer chains. In the capillary model the water molecules in a pore make a water channel for a dye molecule to diffuse through. In the free-volume model, the diffusion region is the amorphous region with water molecules where the polymer segments move actively under segmental micro-Brownian motion.

The crystalline polymer solids have very complex supermolecular structures because of the coexistence of crystalline and noncrystalline regions. Although the noncrystalline region is the principal area for diffusion of penetrants, both the dispersion state of the crystals and its content (crystallinity) directly influence penetrant transport, and the domain boundary of a crystal may affect the transport indirectly.

Fig. 3 shows there is a tendency in a crystal to retain its molecular conformation even in the noncrystalline region.

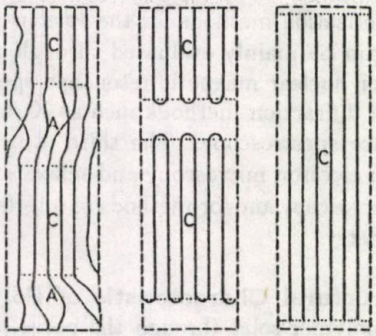

Fig. 3.– Typical molecular arrangement in a crystal: (*a*) fringed micelle; (*b*) folded-chain crystal; (*c*) extended chain crystal.

The noncrystalline region of isotactic polypropylene shows two peaks in the curve of X-ray intensity of wide-angle diffraction versus diffraction angle. The first indicates a distance of ca. 0.4 nm, which corresponds to the distance between the nearest-neighbor side chains, and a longer one that varies depending on the length of the side chains and corresponds to the distance between adjacent chains.

When we define the noncrystalline region as the part not belonging to the crystalline region, then its content vary depending on the evaluation method employed for the crystalline region. Table 2 shows some examples of the extent of the noncrystalline region evaluated on the assumption that the content is equal to 1-crystallinity. The content cannot be determined definitely.

Table 2
Content of Noncrystallinity Region[a)]
with Three Methods of Evaluating Crystallinity

Polymer	X-ray[b)]	IR[c)]	Density[d)]
Polyethylene terephthalate	0.60	0.25	0.39
Polypropylene	0.26	0.28	0.27
Regenerated cellulose	0.05	–	0.25

[a)] Given by 1-crystallinity; [b)] Wide-angle X-ray diffraction method; [c)] Infrared ray method; [d)] Apparent density method.

4. Concluded Remarks. The supermolecular structure of a polymer solid in two ways by the chemical structure (the first-order structural factor) and the preparation conditions. Penetrant transport is governed by three functional factors of the supermolecular structure, the thermal motion of polymer chains, and the intermolecular interaction between the penetrant and the polymer chain. Because of the structural complexity and heterogeneity of the solid, it is very difficult to obtain a complete view of the structure. As for the relation to penetrant transport, the evaluation of the second- and third-order structural factors, that is, the characterization of the supermolecular structure on a nanometer scale, is important. The methods of novel

microscopies such as scanning probe microscopy, atomic force mircoscopy, friction force mircoscopy, and magnetic force microscopy are very powerful tools for investigating supermolecular structure.

To correlate supermolecular structure and penetrant transport we must employ an adequate transport model. Although the free-volume model and the capillary model and their combinations have been proposed so far, some modifications or the use of new models that take supermolecular structure into account are needed. Combined with advanced theory, a novel preparation method for a polymer solid guided by theory should be developed in the future for preparing solids with the desired penetrant transport properties.

Received, January 7, 1998

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STRUCTURA SUPRAMOLECULARĂ A POLIMERILOR SOLIZI ŞI EFECTELE EI ÎN TRANSPORTUL PENETRANT

(Rezumat)

Se prezintă metodologia pentru obţinerea şi dezvoltarea noilor materiale fibroase în domeniul transportului penetrant, descrierea generală a structurii supramoleculare, modelul capilar şi modelul volumului liber, structura supramoleculară a polimerilor solizi cristalini – filme şi fibre, caracterizarea porozităţii etc.

Sunt analizate, de asemenea, tranziţiile de fază şi mişcarea microbrowniană în corelaţie cu proprietăţile de transport penetrant ale polimerilor fibroşi.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

THE THERMAL BEHAVIOUR OF SOME POLYESTER AND WOOL BINARY MIXTURES

BY

ADRIANA JUMUGA, PULFERIA NICOLAIOV, M. CIOCOIU, I. CĂLUGĂREANU* and DANA IONESCU*

We studied the thermal behaviour of four binary wool-polyester textiles with various compositions. The results obtained have been compared with those of the pure compounds. The study aims at the determination of the boundary technological parameters for the fibers' manufacturing and exploitation. We also obtained a standard curve (quantity of eliminated water-fiber's composition) useful for establishing the composition of different mixtures made of wool and any other hydrophilic compound.

1. Introduction. The polyester fiber possesses a good resistance, in both dry and wet medium, at the action of mechanical and thermal agents and micro-organisms, as well as a high elasticity – comparatively with the wool fiber – considered as having the best characteristics of psycho-sensorial and thermo-physiological comfort.

Polyester and wool binary mixtures have been created for improving the textile materials' performances during their manufacturing and exploitation. Thus, a 50% polyester percent increases resistance two times, while the cost of a suit decreases with about 20-30% [1].

The good elasticity and low crack (0.4-0.5%) of the polyester fiber assures shape's stability and a reduced contraction during wearing and in conditions of humidity. The thermal stress at 160°, applied for 30 days, causes a decline of resistance of only 25% [1], [2].

The polyester's presence in woven materials induces a series of difficulties in garment manufacturing, as follows:

– The temperatures applied in thermal and humido-thermal treatments being higher than the thermo-fixing temperatures, cause the woven materials' thermal contraction, creasing and increasing rigidity, fibers' superficial melting and adherence to the working organs;

– Stiffening of the polyester and woven mixture makes spatial modelling by humido-thermal procedures difficult;

– Spatial modelling of the polyester-containing woven by constructive methods (clips, sections) is also difficult, causing higher manual labor expenses (cutting, sewing), higher consumption of material, sewing defects, such as folds of material layers, etc.;

– The temperatures obtained during sewing and cutting processes exceed the polyester's melting temperatures, so that special technical solutions have to be found for avoiding such a phenomenon [3], [4].

Increase of the melting temperatures of synthetic polymers by the occurence of cross links between the macromolecules – which, in the case of wool, explains the inexistence of either a melting point or a melting domain – makes the synthetic fibers' spinning difficult.

Consequently, the study of the thermal behaviour of such materials is both necessary and opportune for an objective substantiation of the main parameters characterizing the technological programs of fiber processing, capable of assuring maintenance of the fabric's initial physico-mechanical properties [5].

On considering the technological complexity of a product such as the men coat and the significant weight of the thermal and humido-thermal treatments in manufacturing processes, the present study analyses a group of materials usually employed in the fabrication of such products (Table 1).

Table 1

Characteristics Thermogravimetric Values

No.	Sample	1-st step					2-nd step					3-rd step				
		T_i	T_m	T_f	ΔT	W_1[%]	T_i	T_m	T_f	ΔT	W_1[%]	T_i	T_m	T_f	ΔT	W_1[%]
1	Wool 100%	25.0	138	158	133	11.5	176	293	450	274	56	450	540	630	180	32.5
2	PES 100%	30.5	90	130	99.5	0.2	330	439	481	151	89.48	481	528	570	89	10.52
3	70%PES+ +30%Wool	31.0	120	189	156	2.45	257	469	538	291	52.47	564	659	782	118	22.9
4	65%PES+ +35%Wool	30.9	127	188	157.1	2.49	243	465	543	300	55.83	557	707	797	240	22.13
5	60%PES+ +40%Wool	31.6	110	136	104.4	3.52	239	455	524	185	55.44	554	631	722	168	16.66
6	55%PES+ +45%Wool	31.1	90	118	87.9	4.49	234	442	504	270	59.3	548	707	777	229	21.97

2. Experimental. We studied the thermal behaviour of four binary wool-polyester textiles with various compositions of their components.

The results obtained have been compared with those of the pure compounds.

An adequate method of investigation – thermogravimetry – was applied, under dynamic conditions of temperature, on a Paulik–Paulik–Erdey device recording simultaneously the thermogravimetric (TG), derived thermogravimetric (DTG), differential thermal analysis (DTA), and temperature (T) curves.

In order to obtain comparable data, the thermograms have been recorded under the same conditions: heating rate of 10°C/min., maximum temperature 900°C, sample amount $\cong$ 100 mg, reference material Al_2O_3, freshly calcinated at 1000°C, in ambient conditions, DTG and DTA sensibility 1/10.

3. Results and discussion. Fig. 1 plots graphically the DTG curves of the pure components, while Fig. 2 – whose of the four binary wool-polyester woven. Such an analysis leads to the conclusion that thermal degradation occurs in three stages,

their aspect being different, as a function of the textile's composition. Actually, the very aspect of the DTG curves of the pure compounds is specific.

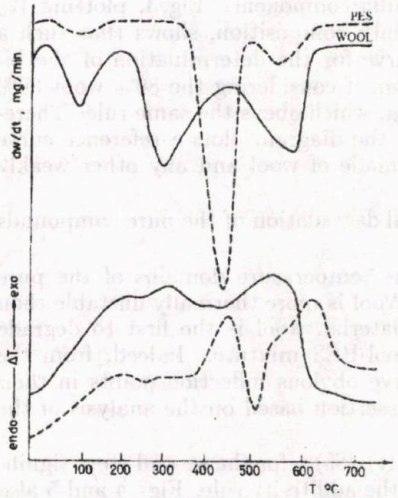

Fig. 1.– DTG and DTA curves of PES 100% (—) and wool 100% (- - -).

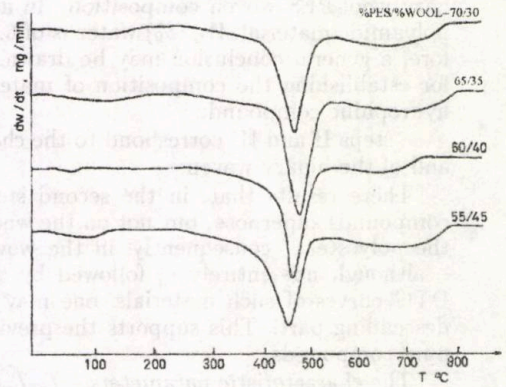

Fig. 2.– DTG and DTA curves of binary mixtures: samples *3* (—), *4* (- - -), *5* (-·-·-), *6* (– –).

Table 1 – listing the characteristic temperatures from DTG and the weight losses from TG for each step – evidences the following aspects:

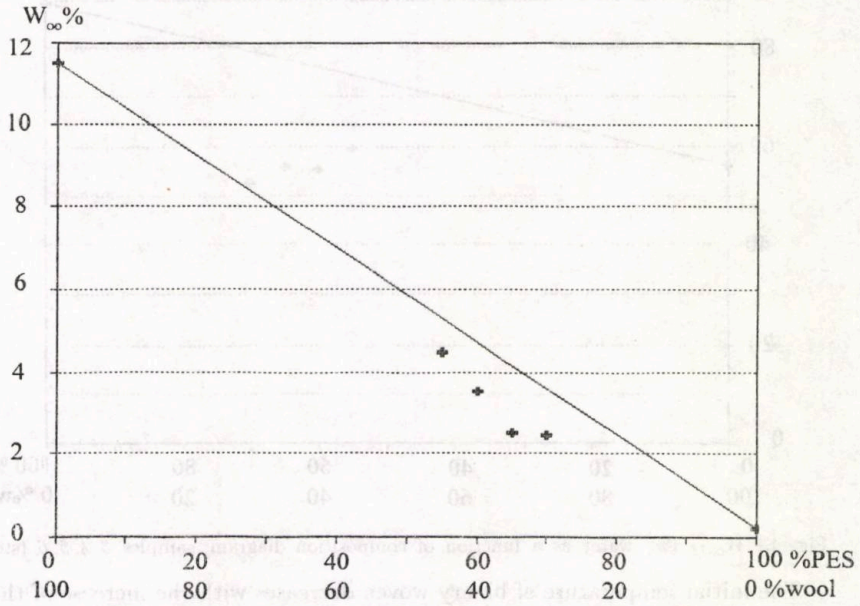

Fig. 3.– $W_{\infty I}$ (%) water as a function of composition diagram: samples *3, 4, 5, 6* (step I).

– in the first step, over the 25...189°C temperature interval, water is eliminated from the textile material's components. The amount of water retained in the fiber depends on the ratio of the strongly hydrophilic component. Fig. 3, plotting W_0 (%), water as a function of the textile material's composition, shows that such a representation could constitute a standard curve for the determination of the binary wool-PES woven composition. In addition, if considering the 80% wool–20% polyamide material, W_0 (%) water is of 6.98 mg, which obeys the same rule. Therefore, a general conclusion may be drawn, that the diagram plots a reference curve for establishing the composition of materials made of wool and any other weakly hydrophilic compound;

– steps II and III correspond to the chemical degradation of the pure compounds and of the binary woven.

There results that, in the second step, the temperature domains of the pure compounds superpose, but not on the whole. Wool is more thermally unstable than the polyester – consequently, in the woven material, wool is the first to degrade – although not entirely –, followed by the wool-PES mixture. Indeed, from the DTG curves of such materials, one may observe obvious inflection points in their descending part. This supports the previous assertion based on the analysis of the pure compounds.

The characteristic parameters – T_i, T_m and W_∞(%) – for the second step, significant for the thermal degradation, do not obey the additivity rule. Figs. 4 and 5 also confirm this conclusion.

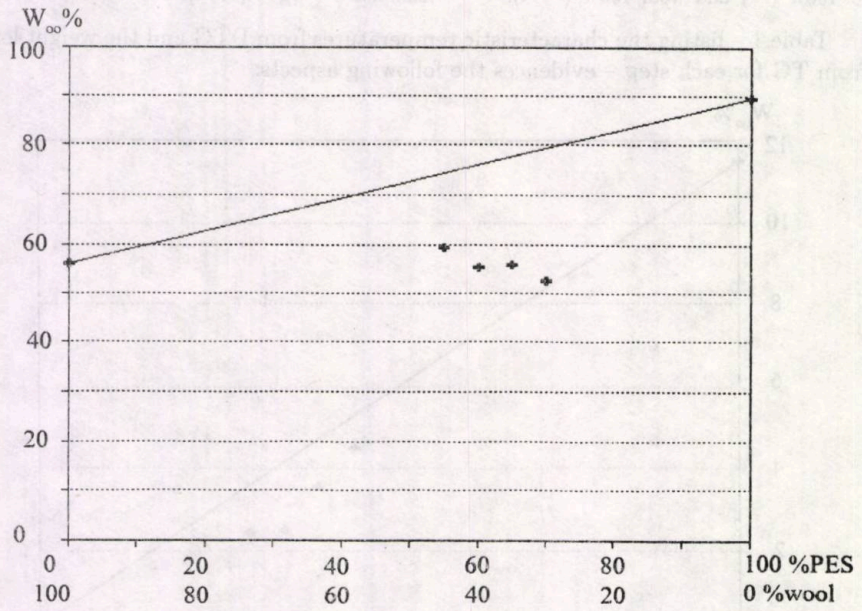

Fig. 4.– $W_{\infty II}$ (%) water as a function of composition diagram: samples *3, 4, 5, 6* (step II).

The initial temperature of binary woven decreases with the increase of the wool ratio, tending towards wool's initial temperature (Fig. 5). Fig. 6 – plotting T_n as a function of composition – evidences its increase with the increase of the polyester

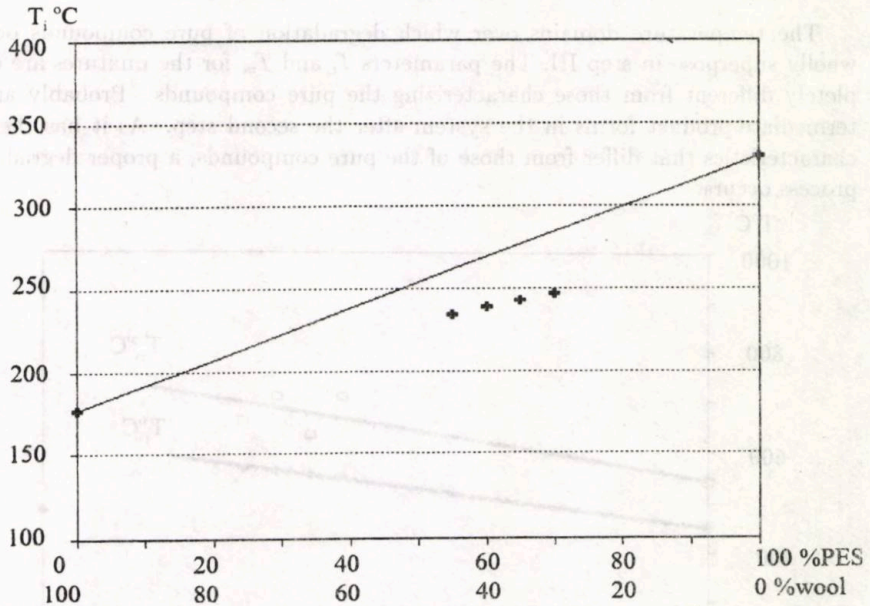

Fig. 5.- T_i (°C) as a function of composition diagram: samples *3, 4, 5, 6* (step II).

ratio. This indicates a complex degradation mechanism, different from that of the pure compounds.

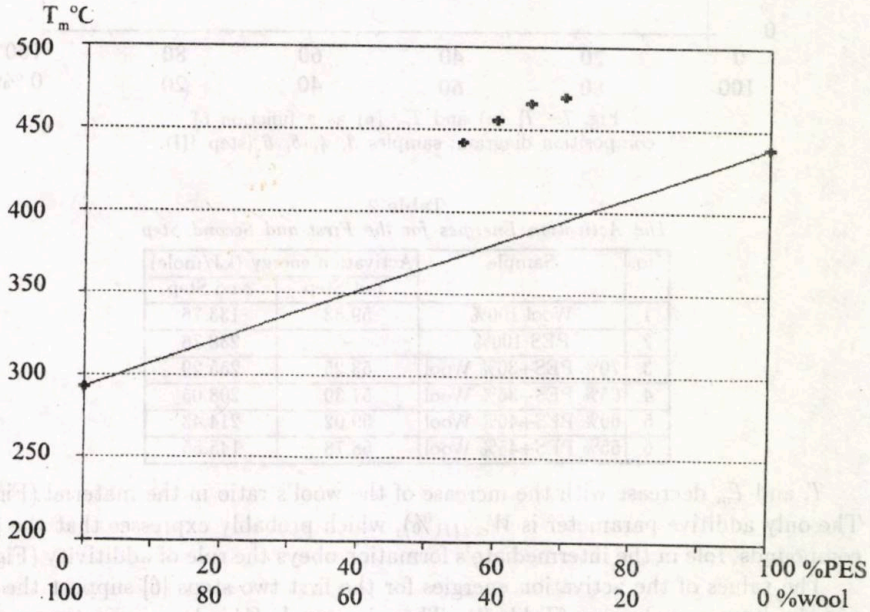

Fig. 6.- T_m (°C) as a function of composition diagram: samples *3, 4, 5, 6* (step II).

The temperature domains over which degradation of pure compounds occurs wholly superpose in step III. The parameters T_i and T_m for the mixtures are completely different from those characterizing the pure compounds. Probably an intermediate product forms in the system after the second step. As it has thermal characteristics that differ from those of the pure compounds, a proper degradation process occurs.

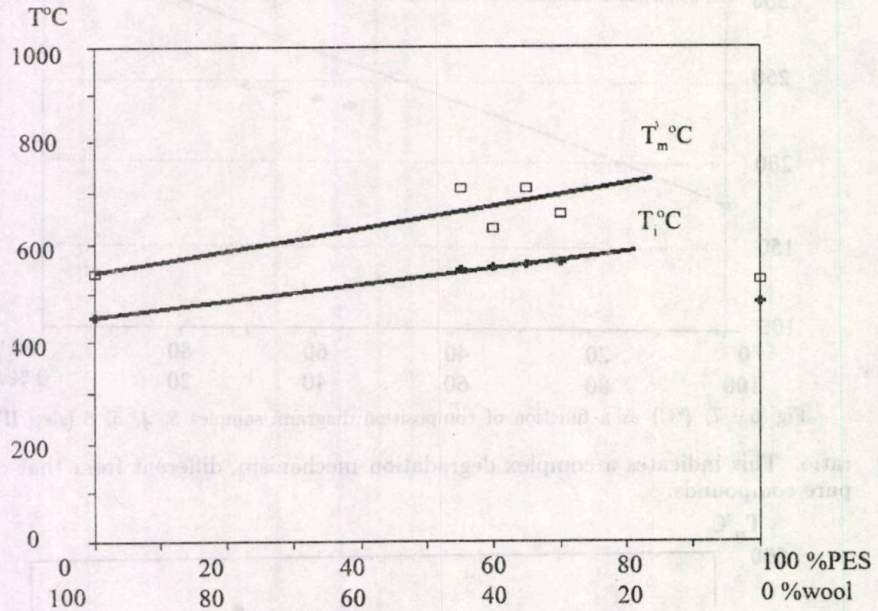

Fig. 7.– T_i (x) and T_m (•) as a function of composition diagram: samples *3, 4, 5, 6* (step III).

Table 2

The Activation Energies for the First and Second Step

No.	Sample	Activation energy (kJ/mole)	
		1-st Step	2-nd Step
1	Wool 100%	59.83	133.76
2	PES 100%	–	238.76
3	70% PES+30% Wool	53.25	255.29
4	65% PES+35% Wool	57.30	208.05
5	60% PES+40% Wool	59.02	214.43
6	55% PES+45% Wool	58.78	145.55

T_i and T_m decrease with the increase of the wool's ratio in the material (Fig. 7). The only additive parameter is $W_{\infty III}(\%)$, which probably expresses that the pure compounds' role in the intermediate's formation obeys the rule of additivity (Fig. 8).

The values of the activation energies for the first two steps [6] support the previously drawn conclusions (Table 2). Thus, in step I, E_a is low, indicating water's physical retention by the hydrophilic compound. In step II, E_a is closer to the

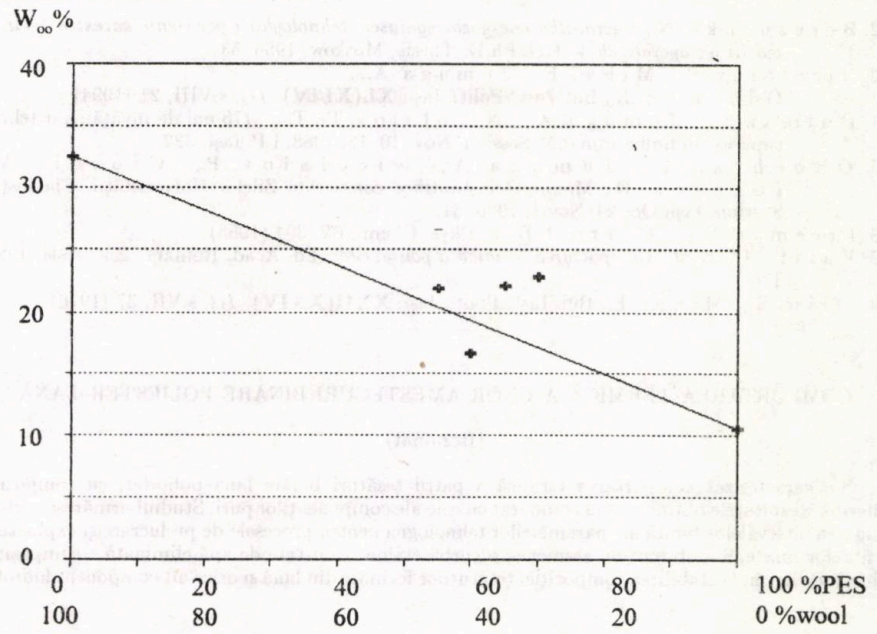

Fig. 8.– $W_{\infty III}$% water as a function of composition diagram: samples *3, 4, 5, 6* (step III).

polyester's one [7] when the PES ratio is high, while, at lower PES ratios, E_a is very close to the wool's one [8].

4. Conclusions. The results obtained permit:

– scientific substantiation of the technological parameters' limiting intervals, characterizing the manufacturing of textiles and vestimentary products;

– sensible adjustment of the technological programs within this group of materials, on considering the variation of the fibrous composition;

– identification of the fibrous composition of the materials processed by clothes' manufacturers working in a Lohn system, who do not usually have access to the necessary information about the basic characteristics of the raw materials.

Received, June 3, 1997

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COMPORTAREA TERMICĂ A UNOR AMESTECURI BINARE POLIESTER–LÂNĂ

(Rezumat)

S-a caracterizat comportarea termică a patru ţesături binare lână–poliester, cu compoziţii diferite. Rezultatele obţinute s-au comparat cu cele ale componenţilor puri. Studiul urmăreşte determinarea intervalelor limită ale parametrilor tehnologici pentru procesele de prelucrare şi exploatare a fibrelor mixte. S-a obţinut de asemenea o curbă etalon (cantitate de apă eliminată – compoziţia fibrei) utilă pentru stabilirea compoziţiei ţesăturilor formate din lână şi orice alt component hidrofil.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

MODELAGE MATHÉMATIQUE DU PROCESSUS D'ENCOLLAGE DES FILS FILAMENTEUX DE POLYESTHÈRE

PAR

DEMETRA-LĂCRĂMIOARA BORDEIANU et M. CIOCOIU

Dans le présent travail les auteurs on établi un modèle mathématique en cinq variables pour le processus d'encollage. On prend en consideration les plus importantes paramètres, à savoir: la vitesse d'encollage, la température du bain d'apprêt, la pression d'essorage, la tension d'alimentation et la concentration de l'apprêt.

1. Introduction. La recherche dans le domaine des textile dispose d'un instrument de travail efficient et moderne: les méthodes statistico-mathématiques et de modelage mathématique. Ces méthodes permettent d'obtenir des informations extrêmement précieuses concernant certains aspects de la recherche et ayant des implications immédiates dans l'établissement des valeurs optimes des paramètres.

L'utilisation du modelage mathématique dans l'étude de l'opération d'encollage est relativement récente et a eu pour but d'observer et de mettre en évidence des aspects partiels de l'opération d'encollage [1],...,[3]. Notre recherche s'est proposé de réaliser un modèle mathématique de l'encollage du fil de polyesthère.

2. Méthode de travail. Un ensemble de paramètres technologiques agissent en même temps sur le fil, qui se trouve dans l'appareil à encoller. L'influence concertée de ceux-ci modifie les propriétés physiques et mécaniques du fil encollé. Elle est donc nécessaire. D'autre part, il est nécessaire d'établir des valeurs pour les paramètres technologiques qui n'influent pas négativement sur ces propriétés. Le problème qui se pose c'est de trouver une expression analytique qui exprime la liaison entre les paramètres de travail de l'appareil à encoller, (les variables indépendantes) et les propriétés physiques à obtenir (les variables dépendantes). Dans ce qui suit ont a pris en considération comme paramètres de base de l'appareil à encoller: la vitesse d'encollage, [m/min]; la température du bain d'apprêt, [° C]; la pression d'essorage, [daN/cm]; la tension d'alimentation, [cN/fil]; la concentration de l'apprêt, [%].

On a consideré la charge d'apprêt du fil comme variable résultante.

3. Planification des expériences. Conformément aux indications bibliographiques [4],...,[7], pour réaliser les expériences on a utilisé la méthode de la planification factorielle des expériences, en adoptant un plan de contrôle composé

rotable pour $K = 5$. L'établissement préalable des valeurs centrales pour les variables indépendantes, ainsi que leur plan de variation dans la région expérimentale considérée, nous a permis de réaliser le Tableau 1.

Tableau 1

Variable	Code	Niveau de la variation				
		-2	-1	0	+1	+2
Vitesse d'encollage	x_1	20	22,5	25	27,5	30
Pression d'essorage	x_2	2	3	4	5	6
Température de l'apprêt	x_3	50	65	60	65	70
Tension d'alimentation	x_4	1,00	1,25	1,50	1,75	2,00
Concentration de l'apprêt	x_5	6	8	10	12	14

Sur la base des indications bibliographiques on a réalisé la matrice des expérimentations du Tableau 2.

Tableau 2

Coefficient	Valeur	Sb	tb
b_1	0,10258	0,0095	10,77
b_2	-0,01835	0,0095	1,986
b_3	-0,1425	0,0095	10,946
b_4	0,10425	0,0095	10,946
b_5	0,46781	0,0086	49,128
b_{11}	-0,0769	0,0086	8,929
b_{22}	-0,0582	0,0086	6,755
b_{33}	-0,0507	0,0086	5,886
b_{44}	-0,0956	0,0086	11,101
b_{55}	-0,0270	0,0117	3,134
b_{12}	0,0360	0,0117	3,087
b_{13}	0,0800	0,0117	6,860
b_{14}	0,0100	0,0117	0,857
b_{15}	0,0025	0,0117	0,2143
b_{23}	0,075	0,0117	0,6431
b_{24}	0,0625	0,0117	5,3593
b_{25}	0,0375	0,0117	3,2155
b_{34}	-0,0487	0,0117	4,1802
b_{35}	0,0487	0,0117	4,1802
b_{45}	0,0462	0,0117	3,9659
b_0	4,1420	0,01861	222,58

On a commencé ensuite à effectuer de manière aléatoire des expérimentations, pour éviter l'apparition d'influences systématiques.

4. Le résultat des mesures a été inscrit au Tableau 2.

Conformément aux indications [8] on a réalisé un programme en langage BASIC avec lequel on a traité les données du Tableau 2 en vue d'obtenir une équation de

régression ayant la forme:

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_{11}x_1^2 + b_{22}x_2^2 + b_{33}x_3^2 + b_{44}x_4^2 + b_{55}x_5^2 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{14}x_1x_4 + b_{15}x_1x_5 + b_{23}x_2x_3 + b_{24}x_2x_4 + b_{25}x_2x_5 + b_{34}x_3x_4 + b_{35}x_3x_5 + b_{45}x_4x_5 \quad (1)$$

Les coefficients de régression obtenus ont été testés, en ce qui concerne leur véracité, en employant le test t (Tableau 3).

Tableau 3

Coefficient	Valeur	Sb	tb
b_1	0,10258	0,0095	10,77
b_2	–0,01835	0,0095	1,986
b_3	–0,1425	0,0095	10,946
b_4	0,10425	0,0095	10,946
b_5	0,46781	0,0086	49,128
b_{11}	–0,0769	0,0086	8,929
b_{22}	–0,0582	0,0086	6,755
b_{33}	–0,0507	0,0086	5,886
b_{44}	–0,0956	0,0086	11,101
b_{55}	–0,0270	0,0117	3,134
b_{12}	0,0360	0,0117	3,087
b_{13}	0,0800	0,0117	6,860
b_{14}	0,0100	0,0117	0,857
b_{15}	0,0025	0,0117	0,2143
b_{23}	0,075	0,0117	0,6431
b_{24}	0,0625	0,0117	5,3593
b_{25}	0,0375	0,0117	3,2155
b_{34}	–0,0487	0,0117	4,1802
b_{35}	0,0487	0,0117	4,1802
b_{45}	0,0462	0,0117	3,9659
b_0	4,1420	0,01861	222,58

Conformément à [9], pour II degrès de liberté $t_{\text{tab}} = 2,200$, les coefficients b_{14}, b_{15} et b_{23} étant donc négligeables. Un cas spécial est présenté par le coefficient b_2 dont la valeur est très rapprochée de la valeur du tableau, raison pour laquelle il a été maintenu dans le modèle. La forme finale de l'équation est la suivante:

$$y = 4,142 + 0,0769x_1^2 - 0,0582x_2^2 - 0,0507x_3^2 - 0,0956x_4^2 - 0,0270x_5^2 + 0,0360x_1x_2 + 0,080x_1x_3 + 0,0625x_2x_4 + 0,0375x_2x_5 - 0,0487x_3x_4 + 0,0487x_3x_5 + 0,0462x_4x_5 \quad (2)$$

L'analyse de dispersion de l'équation présentée au Tableau 4, montre que, pour cette équation, tous les coefficients sont fortement signifiants, le modèle étant donc hautement adéquat. Cela est souligné aussi par la comparaison des valeurs mesurées et des valeurs calculées sur la base de l'équation (Tableau 2).

On observe que les différences entre les deux valeurs sont inférieures à 10%, ce qui démontre que l'équation (2) représente de manière exacte le processus modelé, à une probabilité de 95%.

Tableau 4

Source	SP	GL	S	Fc
Termes linéaires	6,0312	5	1,2062	554,136
Termes de II^{ème} ordre	17,3657	12	1,4471	664,783
Erreur de la régression	13,4348	6	2,2391	1017,772
Erreur expérimentale	0,0109	5	0,022	
Total	9,973	31		

5. Conclusions. On a établi un modèle mathématique en 5 variables pour le processus d'encollage des fibres de polyesthère filamenteux.

Ce modèle, le plus complet établi jusqu'à présent, prend en considération la majorité des paramètres technologiques ayant une influence significative sur la charge d'apprêt.

Reçue le 1 September 1997

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MODELAREA MATEMATICĂ A PROCESULUI DE ÎNCLEIERE A FIRELOR FILAMENTARE POLIESTERICE

(Rezumat)

Se stabileşte un model matematic, în cinci variabile, al procesului de încleiere. Sunt luaţi în considerare cei mai importanţi parametri ai procesului de încleiere şi anume: viteza de încleiere, presiunea de stoarcere, tensiunea de alimentare, temperatura şi concentraţia băii de apret.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

METHOD AND DEVICE FOR MEASURING THE INTERSECTING DRAFT FORCE IN WOOL SPINNING

BY

MIRCEA NETEA and MARIUS CARAIMAN

For measurement of draft force on intersecting in wool spinning, there was designed and manufactured a device which offers the possibility to establish this value, by dynamic method (during the machine functioning); the paper presents the functioning principle of device.

1. Introduction. The draft force is a fundamental quantity in thread processing during spinning. This force is influenced [1], [2], [4] by:

– the structure of the processed chain and the characteristics of the constitutive elements (fibers): length density of the fibers and of the processed semimanufactured goods; the nature of the raw material (the surface characteristics of the fibers); the distribution diagram of the fiber length; the degree of orientation and parallelism of the fibers, etc.;

– the technological parameters of the drafting process: the magnitude of the doubling, draft and draft speed, the size of the gauges, the pressure forces on the cylinders, etc.;

– the constructive parameters of the drafting device: the devices controlling and driving the fibers through the drafting field (pinned bars, in case drawing frames are used) have a special influence in this force.

The random distribution of the fibers along the semimanufactured goods an threads and their quality, as regards the uneveness, is the result of the cumulated effect of all these factors.

The draft force can be measured both by static and by dynamic methods.

The static method implies the measurement of the adherence force, simultaneously with the increase in the distance between the clamps of the apparatus and the graphic recording of the effort–elongation diagram. These trials are easy to perform, but they can not reflect the physical phenomena which happen when placing the fibers in the draft boards, whose organs are moving.

The dynamic measurement of the draft force can be achieved continuously, simultaneously with the passage of the fibers through the draft board; although they are relatively infrequent, the literature contains a series of methods and devices proposed for the measurement of this quantity, as well as the results of the studies performed

by their means.

The following device was conceived for the dynamic measurement of the draft force, on intersecting drawing frames. The method consists in measuring the torque needed for driving the drawing-off cylinders during idle-running regime and during normal functioning, with fibrous material.

2. Constructive principal of the device for measuring the draft force. The device was adapted in order to be fixed on the Sant' Andreea Novara drawing frames, but it could be fixed on other constructive types of drawing frames as well.

The measurement of the draft force during the operation of the machine can be attained with a very simple device, fixed on the route of the gear belt which drives the inferior drawing-off front cylinder. In its turn, this drives the rear cylinder, by means of a gear-tooth system, while the superior cylinder, covered with a antistatic rubber fitting, is driven by simple friction.

In Fig. 1, the circuit of the gear belt, from the driving gear (D_1, z_1) to the driven gear (D_2, z_2), fixed on the shaft of the anterior drawing-off cylinder, is shown.

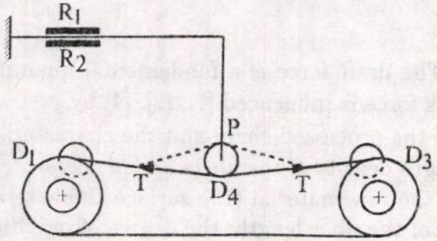

Fig. 1.– Measurement principle of gear belt force.

The belt is maintained in a tensed state by means of the adjustable roll (D_4). On this roll acts the net force P, resulting from the summation of the two forces T acting in the belt.

Knowing the force P, the magnitude of the draft force (needed in order to extract the fibers by the drawing-off cylinders, through the pins of the bars) can be computed graphically or analytically.

If the title of the drawn-off band is also known, the specific draft force SDF can be worked out (cN/tex).

By means of this device, the force P of the belt, acting on the mobile roll, is measured.

The device consists of a support (*1*) of the belt idler (D_4), fixed with screws on a branch, which is bent, as it is fastened in the console.

The variation of the displacement is transformed into an electric quantity.

The electric signal is measured with the TF apparatus, on which the value indicated by the needle is read.

For the measurement of the tension in the gear belt, the tensile method was chosen. According to this method, a strain gauge glued on an elastic element (a girder, e.g.), embedded at one end, changes its electric resistance proportionally with the effort producing its bending.

For the measurement of the variation of the electric resistance, two strain gauges were glued on the elastic girder (R_1, on the superior surface and R_2, on the inferior surface).

During the operation of the machine, the tensions in the two branches of the gear belt sum up. giving the net force P, which bends the elastic element (*2*).

If the D_4 roll is aroused, the fibers on the superior surface are compressed (R_1 es diminished), and those placed on the inferior surface are elongated (R_2 is increased).

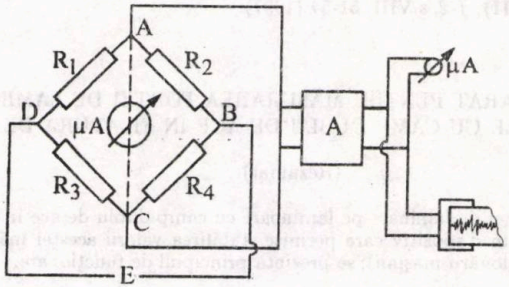

Fig. 2.– The positioning of strain gauges in a flow chart type Wheatstone.

If the two strain gauges are connected in a Wheatstone bridge (Fig. 2), balanced during idle-running regime, then in the presence of the fibrous material, the tension in the belt is diminished, R_1 and R_2 change their values and the bridge becomes unbalanced; in the AC diagonal, a current proportional with the effort appears. After amplification, this signal can be read on a micro-ammeter or can be recorded.

The measurement in double bridge (R_1 and R_2) has the advantage that the sensibility is twofold increased and the errors due to the temperature variation are eliminated.

The calibration consists in the submission of the elastic element to a controlled load in the direction of the force P and the adjustement of the amplification, until a correspondence is achieved between the reading on the apparatus and the calibration load.

3. Conclusions. This device allows the dynamic measurement (during the operation of the machine) of the draft forces in intersecting drawing frames. The necessity of the optimization of their technological parameters is proved by the fact that these drawing frames are used in more than ten passages of the combed wool drafting.

By means of this device, the authors were able to find out the magnitude of the draft force in the intersecting drawing frames and to establish the influence of certain factors [4]. Among other things, the draft force was found to be influenced by the thinness of the processed fibers, the fibers loading of the draft board, the size of the draft and of the gauge, etc.

Received, December 15, 1997

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METODĂ ŞI APARAT PENTRU MĂSURAREA FORŢEI DE LAMINARE LA LAMINOARELE CU CÂMP DUBLU DE ACE ÎN FILATURA DE LÂNĂ

(Rezumat)

Pentru măsurarea forţei de laminare pe laminoare cu câmp dublu de ace în filatura de lână a fost proiectat şi realizat un dispozitiv care permite stabilirea valorii acestei mărimi prin metoda dinamică (în timpul funcţionării maşinii); se prezintă principiul de funcţionare.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

UN MODÈLE MATHÉMATIQUE DU COMPORTEMENT CINÉMATIQUE DU MÉCANISME À CAMES À TÊTE ROTATIVE DE COMMANDE DES BARRETTES À AIGUILLES DE L'INTERSECTING DE LAINE TYPE L.L. UNIREA

PAR
FLORINA-LILIANA BUZESCU, GLORIA GALEA* et N. IRIMICIUC

On présente un modèle mathématique du comportement cinématique du mécanisme à cames à tête rotative de commande des barrettes à aiguilles de l'intersecting de laine type L.L. Unirea, en précisant la loi de mouvement des barrettes, les paramètres cinématiques du mouvement et les autres éléments de cinématique, comme l'accélération d'entraînement et l'accélération complémentaire, nécessaires à leur étude dynamique.

1. Introduction. La tête rotative de commande des barrettes à aiguilles – dont est équipé l'intersecting type L.L. Unirea – se remarque par le fonctionnement à l'aide des brides et des cames, la commande des barrettes à mouvement rotatif et continu, le trajet linéaire dans la zone de travail, ainsi que par la sortie verticale des barrettes des fibres en travail, en évitant ainsi la déterioration de la matière textile. Le mécanisme est doté par un double champ aiguillé avec 52 barrettes par champ. Dans ce travail on établit un modèle mathématique du comportement cinématique du mécanisme à tête rotative à barrettes intersectantes, considérant seulement le champ aiguillé supérieur; on précise la loi de mouvement des barrettes, les paramètres cinématiques du mouvement ainsi que les autres éléments nécessaires pour son étude dynamique, comme l'accélération d'entraînement et celle complémentaire des barrettes respectives. Les hypothèses simplificatrices de travail que nous proposons rendent possibles la réduction du problème spatial de l'étude du mécanisme à un problème plan et l'étude du mouvement relatif des barrettes par rapport à l'axe à tête rotative, seulement à l'étude du mouvement relatif de leur translation rectiligne.

2. La présentation des éléments composants du mécanisme de commande des barrettes à aiguilles. Le mécanisme dont le modèle mathématique de comportement cinématique est présenté dans la Fig. 1 constitue un système mécanique composé par les éléments suivants:

– un ensemble rigidifié en mouvement de rotation commandé autour de l'axe horizontal fixe (Δ), constitué à son tour par les pièces: (*1*) l'axe d'entraînement en rotation; (*2*) disques identiques fixés sur l'axe; (*3*) rainures rectilignes pratiquées dans les disques, dont les axes sont tangents au cercle (Γ) de rayon r; chaque disque

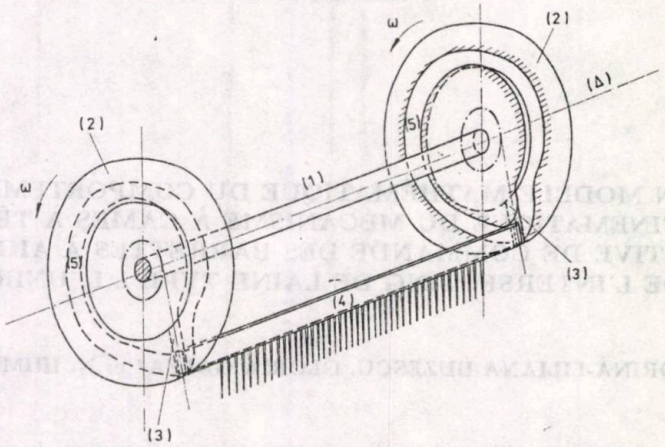

Fig. 1

présente 52 rainures avec leurs axes disposés regulièrement ainsi qu'elles forment des angles égaux entre elles;

– un ensemble de 52 barrettes à aiguilles, les extrémités de chacune – les brides – placées dans une de 52 rainures des disques (*2*), de sorte que les barrettes restent toujours parallèles entre elles et horizontales; les brides des barrettes glissent à frottement coulombien à l'intérieur des rainures des disques;

– un système de cannelures de guidage (*5*), fixe, qui commande les mouvements relatifs dans les rainures des brides; les brides s'appuient toujours sur l'une des deux surfaces cylindriques intérieures des cannelures (*5*).

3. Hypothèses simplificatrices de travail. Sous l'aspect constructif, le mécanisme examiné présente une symétrie parfaite par rapport à un plan vertical, normal à l'axe géométrique de l'axe (*1*) d'entraînement des disques dans son centre; à cette constatation on associe les hypothèses simplificatrices de travail suivantes.

1° Le chargement des barrettes à aiguilles dans la zone effective de travail présente aussi la même symétrie par rapport au plan vertical de symétrie constructive du mécanisme; ce chargement est représenté par une distribution de forces de peignage horizontales parallèles, réductible à une force résultante horizontale située dans le plan de symétrie constructive du système mécanique.

2° Les mouvements relatifs des barrettes à aiguilles par rapport à l'ensemble rigidifié axe-disques sont des translations, donc on peut négliger la desynchronisation des mouvements des deux brides de chaque barrette.

3° L'ouverture de la cannelure de guidage (*5*) devant chaque rainure du disque (*2*) est approximativement égale à l'épaisseur de l'extrémité de la barrette dans la rainure respective; cela signifie que pendant le fonctionnement du mécanisme, le mouvement relatif de la barrette est commandé par le guidage de la cannelure fixe (*5*).

L'hypothèse 1° permet de réduire le problème spatial de l'étude du mécanisme considéré à un problème plan, correspondant à un modèle mécanique équivalent à celui réel; ce modèle est représenté par le disque à rainures (D_c), situé dans le plan de symétrie mentionné et par le coulisseau (P_c) équivalent du point de vue mécanique à la barrette. Le coulisseau (P_c) glisse en même temps, tant au long de la rainure du disque, qu'en long de la coulisse (Cl) (Fig. 2).

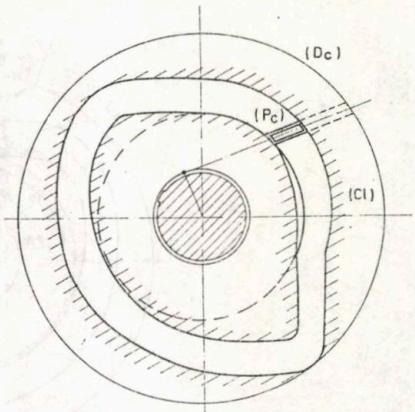

Fig. 2

Les caractéristiques mécaniques – inertiales, cinétiques et dynamiques – du disque (D_c) seront les mêmes que celles de l'ensemble rigidifié axe–disques, et celles du coulisseau (P_c) seront identique à celles d'une barrette.

On précise que dans la Fig. 2 a été représentée par le coulisseau (P_c) une seule barrette; en réalité, le modèle mécanique équivalent dans la Fig. 2, contiendra un nombre de 52 coulisseaux disposés selon une certaine régularité angulaire en disque.

Les hypothèses 2° et 3° conduisent à la conclusion que le mouvement relatif du coulisseau – respectivement d'une barrette – est préétabli; ce mouvement est déterminé, d'une part, par le mouvement d'entraînement du disque et, d'autre part, par la forme de la coulisse (Cl), c'est-à-dire de la cannelure de guidage (Fig. 2).

La nécessité obligatoire du glissement permanent du coulisseau le long de la rainure du disque réduit le problème de l'étude du mouvement relatif de ce coulisseau seulement à l'étude du mouvement relatif de sa translation.

4. Éléments de cinématique du mécanisme considéré. Pour effectuer cette étude cinématique on introduit les systèmes de référence cartésiens plans orthogonaux droits suivants:

– le repère cartésien fixe $R = Oxy$, à l'origine O dans le centre du disque (D_c) (l'axe Ox est horizontal, l'axe Oy est vertical);

– le repère cartésien fixe $R'' = O''x''y''$, invariablement attaché au disque (D_c), choisi de sorte qu'à un moment $t_0 = 0$ – considéré le moment initial pour l'étude cinématique qui sera effectuéee – il se trouve à la position $O''x''_0y''_0$, superposé sur le repère fixe (Fig. 3); la position à un moment donné, $t > t_0$, du repère (R'') sera déterminée, par rapport au repère fixe (R), par l'angle de rotation d'entraînement;

– le repère cartésien $R'_i = C_ix'_iy'_i$ $(i = 1, 2, ..., 52)$, associé à une barrette au numéro d'ordre i, dont l'origine est dans le centre C_i du coulisseau qui représente cette barrette, à l'axe $C_ix'_i$ orienté selon l'axe de la rainure du disque au long duquel glisse ce coulisseau, à l'axe $C_iy'_i$ complétant le repère orthogonal (Fig. 3).

On note avec l'indice d'ordre 1 le coulisseau dans la rainure du disque qui a, au moment initial considéré, la position horizontale $B^0_1D^0_1$.

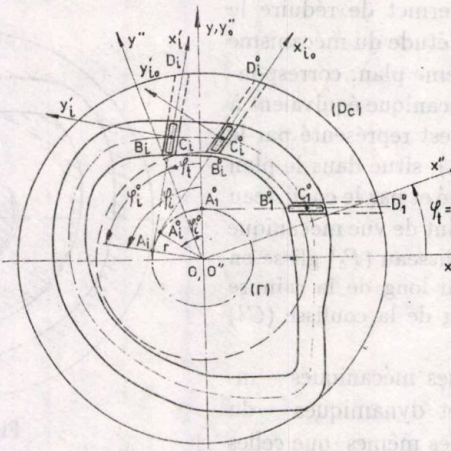

Fig. 3

La position au même moment initial de la rainure dans laquelle glisse l'élément générique, au numéro d'ordre i, sera déterminée par l'angle polaire φ_i^0 formé par le rayon $O''A_1^0$ du point tangentiel de l'axe de la rainure $B_1^0D_1^0$ avec l'axe vertical Oy égal évidemment à l'angle formé par l'axe $A_1^0D_1^0$ de la rainure avec l'horizontale (Fig. 3). Dans la Fig. 3 on observe qu'à la rotation de l'angle φ_t du repère (R''), l'axe de la rainure i atteindra la position A_iD_i avec le rayon r de l'extrémité A_i^0 formant avec la verticale l'angle:

$$\varphi_i = \varphi_t + \varphi_i^0 \quad (i = 1, 2, ..., 52). \tag{1}$$

Dans les conditions précisées, le mouvement d'entraînement sera déterminé par les équations paramétriques:

$$\bar{r}_{O''} = O; \quad \varphi_t = \omega_0 t, \tag{2}$$

avec les conséquences cinématiques:

$$\bar{v}_{O''} = O; \quad \bar{\omega}_t = \omega_0 \bar{k} \tag{3}$$

et

$$\bar{a}_{O''} = O; \quad \bar{\varepsilon}_t = O. \tag{4}$$

Pour définir aussi le mouvement relatif d'une barrette à aiguilles à un numéro d'ordre quelconque i, il faudrait tout d'abord établir quelques relations auxiliaires.

Ainsi, on peut établir une relation en observant (Fig. 4) que la position au repère (R'') du centre C_i, situé sur l'axe du coulisseau (Cl), est déterminée par le rayon vecteur:

$$\overrightarrow{OC_i} = \overrightarrow{OA_i} + \overrightarrow{A_iC_i}. \tag{5}$$

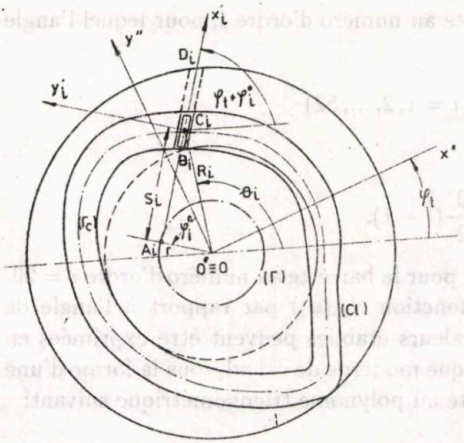

Fig. 4

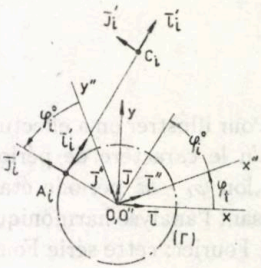

Fig. 5

Les expressions analytiques des vecteurs dans la relation (5) seront:

$$(6) \qquad \overrightarrow{OC_i} = \vec{r}''_{C_i} = x''_{C_i}\vec{i}'' + y''_{C_i}\vec{j}'', \quad \overrightarrow{OA_i} = r\vec{j}'_i \quad \text{et} \quad \overrightarrow{A_iC_i} = S_i\vec{i}'_i.$$

La relation (5) se retranscrit en fonction des expressions analytiques des vecteurs composants données par les relations (6), puis elle se multiplie scalairement, à tour de rôle par les verseurs $\vec{i}'', \vec{j}''$ du repère (R'') (Fig. 5), en tenant compte du tableau suivant de cosinus directeurs:

(7)

	$\vec{i}''$	$\vec{j}''$
$\vec{i}'_i$	$\cos\varphi_i^0$	$\sin\varphi_i^0$
$\vec{j}'_i$	$-\sin\varphi_i^0$	$\cos\varphi_i^0$

obtenant ainsi les expressions suivantes pour les coordonnées x''_{C_i} et y''_{C_i} du centre C_i:

$$(8) \qquad x''_{C_i} = -r\sin\varphi_i^0 + S_i\cos\varphi_i^0, \qquad y''_{C_i} = r\cos\varphi_i^0 + S_i\sin\varphi_i^0.$$

Le mouvement relatif d'une barrette à aiguilles à un numéro d'ordre quelconque i, $(i = 1, 2, ..., 52)$, peut être maintenent défini par les équations paramétriques suivantes:

$$(9) \qquad \vec{r}''_{C_i} = (-r\sin\varphi_i^0 + S_i\cos\varphi_i^0)\vec{i}'' + (r\cos\varphi_i^0 + S_i\sin\varphi_i^0)\vec{j}'', \qquad \varphi_r = 0.$$

La fonction S_i (Fig. 4) pourra être déterminée facilement dans le triangle rectangle OA_iC_i en fonction de r, le rayon du cercle (Γ) auquel sont tangents les axes de toutes les rainures du disque (D_c) et de R_i, le rayon de la courbe (5); puisque on ne connaît pas l'équation analytique de la courbe médiane (Γ_c), le rayon R_i sera déterminé par des mesures directes, pour des valeurs croissantes de 5° en 5° de l'angle φ_t (Fig. 4),

correspondantes à la position de la barrette au numéro d'ordre i, pour lequel l'angle φ_i aura l'expression:

$$\varphi_i = \varphi_t + \varphi_i^0 \ (i = 1, 2, ..., 52) \tag{10}$$

avec

$$\varphi_i^0 = \frac{360^\circ}{52}(i-1). \tag{11}$$

Pour illustrer on a effectué des mésures pour la barrette au numéro d'ordre $i = 20$.

Vu le caractère de périodicité de la fonction $S_{20}(\varphi_t)$ par rapport à l'angle de rotation φ_t – la période étant 2π – les valeurs établies peuvent être exprimées en utilisant l'analyse harmonique et la technique moderne de calcul, sous la forme d'une série Fourier; cette série Fourier est réduite au polynôme trigonométrique suivant:

$$S_{20}(\varphi_t) = \frac{a_0}{2} + \sum_{\lambda=1}^{15}[a_\lambda \cos(\lambda\varphi_t) + b_\lambda \sin(\lambda\varphi_t)], \tag{12}$$

ou a_λ et b_λ sont les coefficients Fourier calculés par la méthode du trapèze, utilisant le logiciel MATHCAD et ils ont les valeurs suivants:

(13)

λ	0	1	2	3	4	5	6	7
a_λ	115	0,934	3,710	2,429	–0,479	1,323	–1,264	0,878
b_λ		3,761	–5,665	2,566	–3,616	0,378	–1,275	0,254

λ	8	9	10	11	12	13	14	15
a_λ	–1,094	0,778	–0,576	0,242	–0,375	–0,306	–0,050	–0,457
b_λ	–0,146	–0,278	0,414	–0,404	0,409	–0,259	0,305	–0,177

Les paramètres cinématiques de premier ordre, du mouvement relatif, sont définis, conformément à la méthodologie de la mécanique théorique, par les relations:

$$\bar{v}_{C_{i_r}} = \frac{\mathrm{d}}{\mathrm{d}t}\left(\bar{r}''_{C_i}\right)_r; \quad \bar{\omega}_r = \frac{\mathrm{d}}{\mathrm{d}t}\left(\varphi_r \bar{k}\right)_r \tag{14}$$

(l'indice r indique l'opération de dérivation relative, qui ne s'applique pas aux verseurs des axes du repère (R'').

Tenant compte des relations (7) et (9), les formules (14) satisferont les conditions:

$$\bar{v}_{C_{i_r}} = \frac{\mathrm{d}S_i}{\mathrm{d}t}(\cos\varphi_i^0 \bar{i}'' + \sin\varphi_i^0 \bar{j}'') = \frac{\mathrm{d}S_i}{\mathrm{d}t}\bar{i}'_i; \quad \bar{\omega}_r = 0, \tag{15}$$

avec

$$\frac{\mathrm{d}S_i}{\mathrm{d}t} = \frac{\mathrm{d}S_i}{\mathrm{d}\varphi_t} \cdot \frac{\mathrm{d}\varphi_t}{\mathrm{d}t} = \frac{\mathrm{d}S_i}{\mathrm{d}\varphi_t}\omega_0, \tag{16}$$

où ω_0 est la vitesse angulaire de valeur constante de l'ensemble rigidifié formé pour les éléments (1), (2) et (3).

Ainsi, on obtient les expressions finales pour les paramètres cinématiques de premier ordre:

$$\bar{v}_{C_{i_r}} = \frac{\mathrm{d}S_i}{\mathrm{d}\varphi_t}\omega_0\vec{i}_i'; \quad \bar{\omega}_r = 0. \tag{17}$$

Pour la barrette au numéro d'ordre i, les relations (17) deviennent:

$$\bar{v}_{C_{20_r}} = \frac{\mathrm{d}S_{20}}{\mathrm{d}\varphi_t}\omega_0\vec{i}_i' = \left\{\sum_{\lambda=1}^{15}\lambda\left[-a_\lambda\sin(\lambda\varphi_t) + b_\lambda\cos(\lambda\varphi_t)\right]\right\}\omega_0\vec{i}_i'; \tag{18}$$
$$\bar{\omega}_r = 0.$$

Les paramètres cinématiques de second ordre du mouvement relatif résultant dans les conditions:

$$\bar{a}_{C_{i_r}} = \frac{\mathrm{d}}{\mathrm{d}t}\left(\bar{v}_{C_{i_r}}\right)_r = \frac{\mathrm{d}^2S_i}{\mathrm{d}t^2}(\cos\varphi_i^0\vec{i}'' + \sin\varphi_i^0\vec{j}'') = \frac{\mathrm{d}^2S_i}{\mathrm{d}t^2}\vec{i}_i'; \tag{19}$$
$$\bar{\varepsilon}_r = \frac{\mathrm{d}}{\mathrm{d}t}(\bar{\omega}_r)_r = 0,$$

qui, en considérant la relation:

$$\frac{\mathrm{d}^2S_i}{\mathrm{d}t^2} = \frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{\mathrm{d}S_i}{\mathrm{d}\varphi_t}\omega_0\right) = \frac{\mathrm{d}}{\mathrm{d}\varphi_t}\left(\frac{\mathrm{d}S_i}{\mathrm{d}\varphi_t}\right)\omega_0\frac{\mathrm{d}\varphi_t}{\mathrm{d}t} = \frac{\mathrm{d}^2S_i}{\mathrm{d}\varphi_t^2}\omega_0^2, \tag{20}$$

auront la forme finale suivante:

$$\bar{a}_{C_{i_r}} = \frac{\mathrm{d}^2S_i}{\mathrm{d}\varphi_t^2}\omega_0^2\vec{i}_i'; \quad \varepsilon_r = 0. \tag{21}$$

Pour la barrette au numéro d'ordre $i = 20$, les relations (21) deviennent:

$$\bar{a}_{C_{20_r}} = -\left\{\sum_{\lambda=1}^{15}\lambda^2\left[a_\lambda\cos(\lambda\varphi_t) + b_\lambda\sin(\lambda\varphi_t)\right]\right\}\omega_0^2\vec{i}_i'; \quad \bar{\varepsilon}_r = 0. \tag{22}$$

5. Détermination des accélérations d'entraînement et Coriolis de la barrette au numéro d'ordre i. Les accélérations d'entraînement et Coriolis (complémentaire) d'une barrette intersectante quelconque seront utilisées dans la dynamique du mouvement relatif de la barrette respective.

L'accélération d'entraînement du point courant C_i considéré dans la barrette qui execute le mouvement relatif a l'expression générale:

$$\bar{a}_{C_{i_t}} = \bar{a}_{O''} + \bar{\varepsilon}_t \times \bar{r}_{C_i}'' - \omega_t^2\bar{r}_{C_i}'', \tag{23}$$

où

$$\bar{a}_{\mathbf{trans}} = \bar{a}_{O''} = 0; \quad \bar{a}_{\mathrm{rot}} = \bar{\varepsilon}_t \times \bar{r}_{C_i}'' = 0; \quad \bar{a}_{\mathbf{ax}} = -\omega_t^2\bar{r}_{C_i}'' = -\omega_0^2\bar{r}_{C_i}''. \tag{24}$$

Si la dernière relation s'exprime de façon analytique en fonction des verseurs des axes du repère (R'), l'accélération d'entraînement du point courant C_i et implicitement de la barrette au numéro d'ordre i aura l'expression finale suivante:

$$\bar{a}_{C_{i_t}} = -\omega_0^2 \bar{r}''_{C_i} = -\omega_0^2 [S_i \vec{i}'_i + r\vec{j}'_i] \quad (i = 1, 2, ..., 52). \tag{25}$$

L'accélération Coriolis (complémentaire) correspondante, aussi, au centre C_i de la barrette intersectante considérée sera déterminée par la relation:

$$\bar{a}_{C_{i_c}} = 2\bar{\omega}_t \times \bar{v}_{C_{i_r}}. \tag{26}$$

Conformément à la relation (3) et à l'expression (17) de la vitesse relative $\bar{v}_{C_{i_r}}$, l'expression (26) de l'accélération Coriolis du point C_i, respectivement de la barrette au numéro d'ordre i, recevra la forme concrète suivante:

$$\bar{a}_{C_{i_c}} = 2\omega_0^2 \frac{\mathrm{d}S_i}{\mathrm{d}\varphi_t} \vec{j}'_i \quad (i = 1, 2, ..., 52). \tag{27}$$

On précise que, dans le cas de la barrette au numéro d'ordre i, l'accélération d'entraînement $\bar{a}_{C_{20_t}}$ et l'accélération Coriolis $\bar{a}_{C_{20_c}}$ seront, en remplacant dans les expressions (25) et (27) les fonctions S_i et $\mathrm{d}S_i/\mathrm{d}\varphi_t$ avec les valeurs S_{20} et $\mathrm{d}S_{20}/\mathrm{d}\varphi_t$, données par la relation (12), respectivement (18).

6. Conclusions. Le modèle mathématique élaboré dans ce travail, du comportement cinématique du mécanisme à la tête rotative de commande des barrettes intersectantes, est nécessaire pour réaliser ultérieurement l'étude dynamique qui permettra l'obtention de nouvelles solutions pour l'amélioration de certains paramètres constructifs et fonctionnels de la machine équipée de ce type de mécanisme.

Reçue le 15 jouillet 1997

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UN MODEL MATEMATIC AL COMPORTAMENTULUI CINEMATIC AL MECANISMULUI CU CAME CU CAP ROTATIV DE ANTRENARE A BARETELOR CU ACE AL LAMINORULUI DE LÂNĂ TIP L.L. UNIREA

(Rezumat)

Se prezintă un model matematic al comportamentului cinematic al mecanismului cu came cu cap rotativ de antrenare a baretelor cu ace al laminorului de lână tip L.L. Unirea, precizându-se atât legea de mişcare a baretelor, parametrii cinematici ai mişcării, cât şi alte elemente de cinematică, cum ar fi acceleraţiile de transport şi complementară a baretelor, necesare studiului dinamic al acestora.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

LES PROPRIÉTÉS GÉOMÉTRIQUES ET STRUCTURALES DES FILS À ÂME ET FILS AUX FIBRES PARALLÈLES

PAR
MARIA AVRAM et DORIN AVRAM

Le travail traite les aspects de la structure des fils à âme et des fils à fibres parallèles. Sur la base d'un programme expérimental on obtient des équations de régression pour les propriétés géométriques et structurales des fils. On a analysé comparativement les valeurs des caractéristiques pour les fils de 15, 18, 20, 25 tex à 300, 400, 500 torsions (spires)/m.

1. Les aspects concernant la structure des fils. Les fils réalisés sur les technologies classiques ou non-conventionnelles ont des caractéristiques, qui les offrent certaines particularités, qui sont dû leur structure.

Le fil à âme a une structure composée d'un âme de fil continu guipé avec des fibres (Fig. 1).

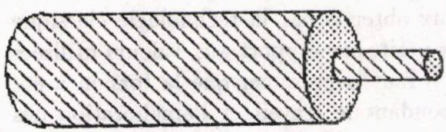

Fig. 1.– L'aspect du fil à âme.

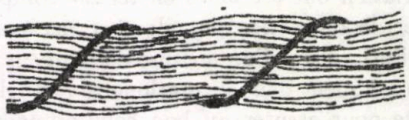

Fig. 2.– L'aspect du fil aux fibres parallèles.

Le fil aux fibres parallèles se caractérise par une structure qui est composée d'une mèche de fibres parallèles qui est guipée par unfil continu (Fig. 2).

Du point de vue structural, les deux types de fils se peuvent comparés et les résultats obtenues se présentent dans le Tableau 1 [1].

2. Les aspects expérimentaux. On a obtenu des fila sur les deux technologies de filage en considérant communes les éléments suivants:

- le mélange de fibres type laine peignée, en section (60% PES + 40% CELO);
- le fil continu (PES étiré 50 dtex/20);
- le nombre de tours/m égal au nombre de spires/m;
- les paramêtres technologiques de filage (l'étirage, l'écartement, la pression, la rotation des broches, etc.).

Les caractéristiques des fibres, du mélange et du fil continu étiré, impliquées dans l'analyse des fils, sont présentées dans le Tableau 2.

Sur la base d'un programme expérimental nomme „programme central composé rotatif à deux variables" [2], on a établi les valeurs codifiées et réelles pour les vari-

Tableau 1

Les comparaisons entre les structures des fils

Comparaison du point de vue:	Fil à âme	Fil aux fibres parallèles
– de la technologie d'obtention	classique	non-conventionnelle
– du processus de filage	métier à filer aux anneaux	filage à fil guipé
– de la position des fibres	les fibres forment le recouvrement du fil et sont inclinées par rapport à l'axe du fil	les fibres forment l'âme du fil et elles sont parallèles à l'axe du fil
– de la position du fil continu	dans le centre et parallèle à l'axe du fil	dans l'extérieur et incliné par rapport de l'axe du fil
– de la position des filaments	inclinés par rapport à l'axe du fil continu	inclinés par rapport à l'axe du fil
– de la sollicitation des fibres	mises en torsion, courbées, étendues	compression par les forces radiales
– de la sollicitation du fil continu	mis en torsion	mis en torsion, courbé, étendu
– de la sollicitation des filaments	mis en torsion, courbés, étendus en fonction de la position radiale dans le fil continu	mis en torsion, courbés, étendus en fonction de la position radiale dans le fil continu

ables indépendantes qui sont: nombre de fibres dans la section du fil (X_1), réalisé par le étirage, et nombre de tours (spires)/m (X_2). Les valeurs du domaine de variation ont été élues en tenant compte de possibilités techniques des métiers à filer, la réalisation des fils plus fins que ceux obtenus par la technologie classique et l'utilisation d'un nombre de tours/m plus petit, par rapport aux valeurs utilisées couramment dans la pratique industrielle. Il faut mentionner que la torsion à été élue pour assurer un bon comportement pendant le travail et l'amélioration des caractéristiques d'aspect et de confort des produits (tissages, tricots). Les valeurs codifiées et réelles des variables et les valeurs moyennes des propriétés géométriques et structurales des fils réalisés, conforme au programme expérimental, sont présentées dans le Tableau 3.

Tableau 2

Caractéristiques des fibres, du mélange et du fil continu étiré

No.	Caractéristiques	U.M.	CELO	PES	Melange 60%PES+ 40%CELO	Fil continu étiré PES
1	Finesse	den	3,7	3	3,24	45/20
2	Longueur initiale	mm	100	–	–	–
3	Longueur moyenne	mm	95,60	75,6	82,1	–
4	Coefficient de variation de la longueur	%	17,86	6,36	22,93	–
5	Diametre	mm	0,0186	0,0179	0,0182	0,1
6	Volume spécifique	cm^3/g	0,658	0,725	0,698	1,57

Sur la base des valeurs moyennes on a déterminé, pour chaque caractéristique, l'équation de régression et à la suite d'un test de signification des coefficients, on a

Tableau 3

Les propriétés géométriques et structurales des fils

Var de travail	V_1 – Fil à âme								V_2 – Fil aux fibres parallèles			
	Valeurs codifies et réelles				Finesse	Diam. apparent	Volume spécifique apparent	Irrégularité USTER CV	Finesse	Diam. apparent	Volume spécifique apparent	Irrégularité USTER CV
	cod		réel		Y_{11}	Y_{12}	Y_{13}	Y_{14}	Y_{21}	Y_{22}	Y_{23}	Y_{24}
	X_{1c}	X_{2c}	X_{1r}	X_{2r}	tex	μm	cm^3/g	%	tex	μm	cm^3/g	%
1	-1	-1	18,95	329	24,85	246	1,912	13,800	24,6	266,7	2,27	13,33
2	1	-1	39,85	329	15,44	174	1,540	15,166	15,07	207,13	2,24	13,67
3	-1	1	18,95	471	27,89	242	1,652	14,933	27,5	277,61	2,2	13,33
4	1	1	39,85	471	17,32	170	1,310	16,530	16,8	215,57	2,17	14,17
5	-1,414	0	14,62	400	28,84	276	2,074	12,600	28,06	289,84	2,35	13,1
6	+1,414	0	44,18	400	14,28	151	1,265	16,566	14,04	180,42	1,82	15,33
7	0	-1,414	29,4	300	19,80	210	1,748	16,000	19,64	233,65	2,18	14,47
8	0	+1,414	29,4	500	21,19	190	1,337	15,233	20,8	235,12	2,09	15,83
9	0	0	29,4	400	19,80	191	1,446	15,660	19,86	230,5	2,1	15,77
10	0	0	29,4	400	20,80	196	1,450	15,330	19,25	229,61	2,15	16,03
11	0	0	29,4	400	20,92	200	1,503	15,233	19,76	234	2,18	15,43
12	0	0	29,4	400	20,50	199	1,516	15,660	20,1	233	2,12	15,17
13	0	0	29,4	400	20,20	195	1,473	15,533	20,5	236	2,13	15,63

X_{1c} – la valeur codifiée de l'étirage;

X_{2c} – la valeur codifiée de la torsion (du nombre de spires) par mètre;

X_{1r} – la valeur réele de l'étirage;

X_{2r} – la valeur réelles de la torsion (du nombre de spires) par mètre.

obtenu les équations du Tableau 4.

Tableau 4
Les équations de régressions

No.	Caractéristiques	U.M.	V_1 – Fil à âme	V_2 – Fil aux fibres parallèles
1	Finesse	tex	$Y_{11} = 20,449 - 5,07X_1 + +0,862X_2 + 0,641X_1^2$	$Y_{21} = 19,899 - 5,007X_1 + +0,789X_2 + 0,663X_1^2$
2	Diamètre apparent	μm	$Y_{12} = 196,25 - 40,094X_1 - -4,535X_2 + 8,921X_1^2$	$Y_{22} = 232,679 - 34,541X_1 + +2,679X_2 + 2,957X_1^2 + 2,584X_2^2$
3	Volume specifique apparent	cm^3/g	$Y_{13} = 1,478 - 0,232X_1 - -0,134X_2 + 0,095X_1^2 + +0,032X_2^2$	$Y_{23} = 2.136 - 0,102X_1 - -0,034X_2 + 0,026X_2^2$
4	Irrégularité CV USTER	%	$Y_{14} = 15,487 + 1,071X_1 + +0,177X_2 - 0,451X_1^2$	$Y_{24} = 15,61 + 0,54X_1 + +0,304X_2 - 0,963X_1^2 - 0,496X_2^2$

Les deux structures de fils se compare du point de vue des caractéristiques physiques et structurales pour les fils à la finesse T_t=15, 18, 20, 25 tex et à 300, 400, 500 tours (spires/m).

2.1. Le diamètre apparent. De ce point de vue (Fig. 3) on observe que la structure des fil aux fibres parallèles offrent la possibilité d'obtenir des diamètres plus grands pour toutes les variantes. Ceci est dû au fait que, les fibre de la structure du fil aux fibres parallèles ont un degré de compacité plus petit réalisé par le guipage du fil continu. Aussi, on constate que si le nombre de spires/m augmente a lieu une faible augmentation des diamètres apparents, parce que il y a une tendance d'ondulation de l'âme, par le fait que la tension du fil continu augmente. Au fil à l'âme, l'augmentation de la torsion conduit à la diminution des diamètres apparents, par le fait que il y a une augmentation des tensions des fibres à cause de la torsion, alors le degré de compacité augmente.

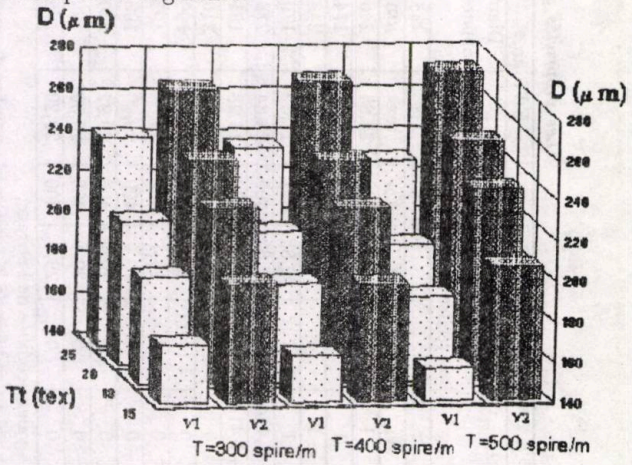

Fig. 3.– Le diamètre des fils.

2.2. Le volume spécifique apparent. Par l'analyse du graphique, Fig. 4, on observe

que le volume spécifique apparent des fils aux fibres parallèles est plus grand, pour toutes variantes, par rapport aux fils à âme. Ceci est dû de la structure spécifique des fils aux fibres parallèles, par le fait que les fibres sont peu serrées par le guipage du fil continu, en face du fil à âme ou les fibre sont bien serrées à cause de la torsion et aussi par la tension plus grande pendant la formation du fil.

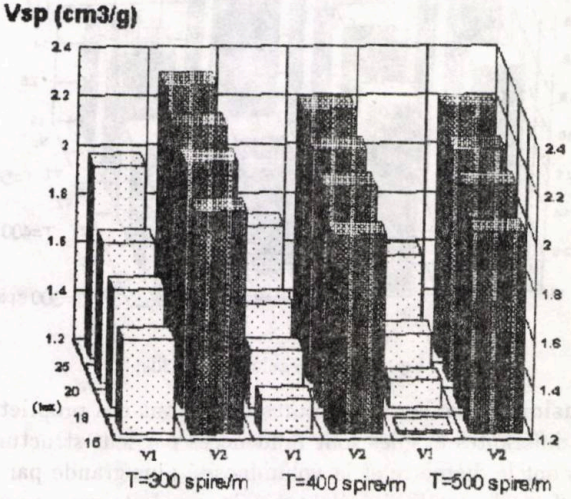

Fig. 4.– Le volume spécifique des fils.

Les deux structures sont affectées par le nombre de fibres en section, donc, d'autant que le nombre des fibres, en section augmente, la voluminosité augmente. Mais en ce qui concerne l'augmentation du nombre de tours ou spires par mètre, il y à une baisse de la voluminozité, plus évidente pour les fils à âme. Ceci s'explique par le fait que les tensions qui apparaissent dans les fibres, à cause de la torsion, sont plus grandes et, en plus, les tensions du fil pendant la formation et au renvidage sont plus grandes par rapport aux conditions de la formation du fil aux fibres parallèles.

2.3. L'irrégularité. La comparaison, des fil du point de vue de l'irrégularité (Fig. 5), met en évidence que les fils aux fibres parallèles, plus gros, ont des valeurs plus petites, donc sont plus uniformes, mais aux fils plus minces il n'y a pas une évolution spécifique.

Puisque, on a été utilise les mêmes conditions technologiques, théoriquement, il ne faut pas des différences, seulement par les conditions de formation des fils. Ainsi, aux fils plus gros, la variation du nombre de fibres est la seule qui peut influencer. Pendant la formation du fil à âme, puisque la tension est plus grande et la torsion est plus petite, alors peut exister des déplacements non-contrôlés des fibres, dans le triangle de la torsion, qui donne une irrégularité plus grande. Quant aux fils minces, le poids du fil continu, en étant plus grand, l'irrégularité est plus petite, mais l'évolution ne suivit pas un certain sens. Donc, l'influence du fil continu est plus favorable pour les fils minces.

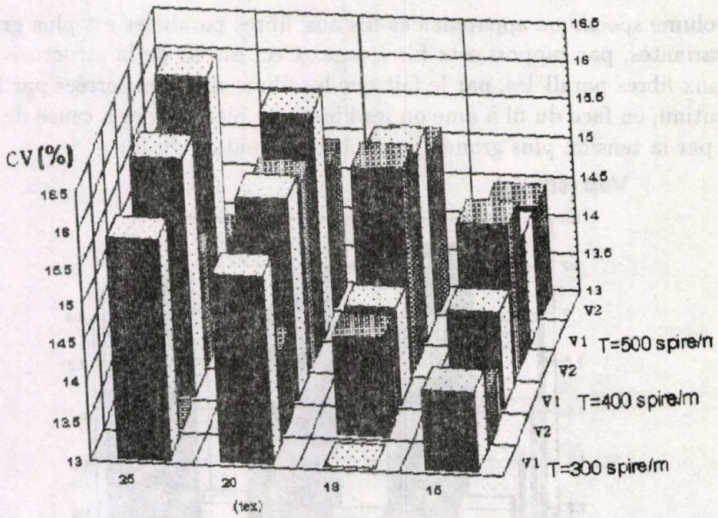

Fig. 5.– L'irrégularité des fils.

3. Les conclusions. Les deux structures de fils ont des proprietes géométriques et structurales différantes et elles sont influencées par leur structures. Les fils aux fibres parallèles ont le diamètre et la voluminosité plus grande par rapport aux fils à âme, ce qui offrent la possibilité d'obtenir des produits aux propriétés de confort améliorées.

Le nombre de fibres, en section du fil, pour les deux structure, influence positif sur le diamètre apparent et sur la voluminosite, mais peu sur l'irrégularité.

L'augmentation de la torsion a une influence négatif sur le diamètre et sur la voluminosite des fils, face au nombre de spires/m qui a une influence plus petite, et on remarque que il y a même une tendance d'ondulation de l'âme de fibres, en favorisant la voluminosité.

Reçue le 28 Août 1997

Université Technique „Gh.Asachi", Jassy,
Chaire de Filature et Tissage

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PROPRIETĂŢILE GEOMETRICE ŞI STRUCTURALE ALE FIRELOR CU MIEZ ŞI ALE CELOR CU FIBRE PARALELE

(Rezumat)

Se tratează aspecte ale structurii firelor cu miez şi ale celor cu fibre paralele. Pe baza unui program experimental se obţin ecuaţiile de regresie pentru proprietăţile geometrice şi structurale ale firelor. S-au analizat comparativ valorile caracteristicilor pentru firele de 15, 18, 20, 25 tex cu 300, 400, 500 tors. (spire)/m.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

SPINNFÄHIGKEIT MANCHER RUMÄNISCHEN VOLLARTEN (24 P) FÜR ERZEUGUNG VON FEINEN WOLLGARNEN UND DURCHFÜHREN EINIGER VERGLEICHUNGEN MIT GARNEN GLEICHER FEINHEIT, DIE AUS IMPORTWOLLE ERZEUGT WURDEN

VON

LĂCRĂMIOARA LEON und MARIUS CARAIMAN

Im Rahmen dieses Betrages wurde eine vergleichende Analyse der Verarbeitung einiger inländischen und importierten Wollarten vorgeschlagen.

Die Analyse der Resultate bezüglich Qualitätseigenschaften der erzeugten Garne, in Verbindung mit der Analyse der Eigenschaften der gebrauchten Fasern gestattet eine Reihe von Sclussfolgerungen und Interpretationen zu ziehen.

a. Was der Wert der Spinnreserve und die Art und Weise des Spinnablaufes anbelangt.

b. Was die Eigenschaften der realisierten Garne anbelangt.

1. Kurze Betrachtungen über Verwendung der Wollarten in der Industrie. Die am feinsten realisierten Garne aus rumänischen Wollarten können eine 22 tex - Längsdichte errerchen. Sogar für dieses Niveau sind die inländischen Wollarten ungenügend (die Produktion des feinsten Sortiments 21 P mit l_f=75...80 mm beträgt nur einige Tonnen).

Darum werden 64's-, 70's- und 74's-Wollarten importiert oder werden Mischungen mit chemischen Fasern verwendet, um feinere Garne zu realisieren.

Das vorliegende Studium hat als Zweck die Verbesserung der Wolleverertung aus der inländischen Produktion.

Rücksicht nehmend auf die Tatsache, dass für Erzeugung von 1 kg Waschwolle ca. 2,6 kg Rohwolle, bzw. für Erzeugung von 1 kg Kammwollebändern ca. 1,5 kg inländische Feinwolle gebraucht wird, folgt daraus die Notwendigkeit alle möglichen Wege zu erforschen, damit eine optimale Entwicklung der Produktionsabläufe in der Wollspinnerei zu gewährleisten.

2. Experimentierprogramm. Im Rahmen dieses Betrages wurde eine vergleichende Analyse der Verarbeitung einiger inländischen und importierten Wollarten vorgeschlagen.

Aus dem industriellen Praktikum geht hervor, dass aus 29 P - Wolle Garne bis zu einer 36 Nm - Feinheit und aus 26 P - Wolle Garne bis zu einer 40 Nm - Feinheit üblicherweise verarbeitet werden können.

Im Rahmen des Experimentes wurden Garne von 36 Nm-, 45 Nm- und 52 Nm - Feinheit aus 100% - Wolle realisiert.

Die im Rahmen des Experimentes verarbeiteten rumänischen Wollarten waren

von Typ 25 P und die verarbeiteten importierten Wollarten waren von Typ 70's. Der Vergleich wurde zwischen diesen zwei Wolltypen gemacht.

Die 24 P – Wollarten haben eine mittlere Feinheit zwischen 21,1 – 24 μ. Gemäss diesem Wertes zeigt das Diagramm eine Nm 43 – Spinnfähigkeit an.

Die 70's – importierten Wollarten haben eine mittlere Feinheit zwischen 19,6 – 21 μ, gemäss den in der technischen Fachliteratur gegebenen Werten. Mit diesen Werten zeigt das Diagramm eine Nm 56 – Spinnfähigkeitsgrenze an.

Im Rahmen des Experimentes wurde beobachtet, ob in der Industrie die oben dargestellten Grenzen erreicht werden können, wie auch die vergleichenden physisch-mechanishen Eigenschaften der realisierten Garne.

Analysiert wurden 24 Partien inländischer Woll – faser (24 P) und 16 Partien importierter Wollfaser (70's).

3. Resultate der experimentalen Bestimmungen

3.1. Vergleichende Eigenschaften der Bänder aus inländischen und importierten Wollarten. Für jede Partie wurden komplette Analysenberichte ausgestellt. Die Durchschnittswerte aller Ermittlungen, vergleichend für inländische und importierte Wolle, werden in der Tabelle 1 dargestellt.

Tabelle 1

Eigenschaften	Inländische Wollarten (24 P)	Importierte Wollarten (70's)
Faserfeinheit (μ)	22,45	20,8
Abweichungskoeffizient (%)	23,65	21,68
Faserlänge (Almeter)		
Hauteur (mm)	50,45	56,41
CV_H (%)	48,42	49,39
Faser unter 40 mm (%)	36,21	32,71
Faser unter 25 mm (%)	10,91	11,17
$l_{5\%}$	141,76	110,13
$l_{1\%}$	120,32	129,8
Titer des Bandes (ktex)	19,49	22,58
Uster-Ungleichmässigkeit	4,8	4,3
Pflänzlicher Schmutz (Stück/g)		
I. Klasse (3 – 10 mm)	0,47	0,54
II. Klasse (über 10 mm)	0,07	0,02
Defekte (Toenissen)		
kleine Knötchen (Stück/g)	2,39	0,89
grosse Knötchen (Stück/g)	1,2	0,25
Anhäufungen-Flammeure (Stück/g)	0,96	0,66
pigmentierte Fasern (Stück/g)	1,6	0,49

3.2. Verglewichende Eigenschaften der aus inländischen Wollarten und aus Importwollarten erzeugten Garne. In der Tabelle 2 werden die Werte der experimentierten Bestimmungen bezüglich Eigenschaften der realisierten Garne und der Index der Bruchfrequenz dargestellt – die die Art und Weise der Entwicklung des Spinnprozesses wiedergeben.

4. Analyse der Resultate. Schlussfolgerungen. Die Analyse der Resultate bezüglich Qualitätseigenschaften der erzeugten Garne, in Verbindung mit der Anal-

Tabelle 2

Garneigenschaften	Nm 36		Nm 45		Nm 52
IFR (index der Bruchfrequenz)	24 P	70's	24 p	70's	70's
Zulässige Ungleichmässigkeit bei Nm, %, maximal	1,68	1,73		1,55	1,6
Torsion/m	516	506	551	574	607
Bruchlast (cN), minimal	147	138	114	107	91,6
Zulässige Ungleichmässigkeit bei Bruchlast (%), maximal	15,4	11,96	17,36	11,96	13,88
Bruchdehnung (%), minimal	6,13	6,47	5,6	6,5	5,7
Uster-Ungleichmässigkeit	14,9	13,73	15,04	14,28	14,2
Dicke Garnstellen	67,3	53,8	86,5	49	89
Dünne Garnstellen	199	128	100	150	198
Knötchen	12,3	22,3	15	15	16
IFR (Brüche/1000 Spulenachsen h)	202,6	99,4	358	134	204

yse der Eigenschaften der gebrauchten Fasern gestattet eine Reihe von Sclussfolgerungen und Interpretationen zu ziehen.

4.1. Was der Wert der Spinnreserve und die Art und Weise des Spinnablaufes anbelangt. Von den Werten der Faserfeinheit beginnend – was einen antscheidenden Faktor der Spinnfähigkeit darstellt – ist es möglich sogar vor dem Experiment zu erkennen, dass der Spinnprozess bei den importierten Wollarten besser abläuft. Laut der Angaben aus der technischen Fachliteratur, ist es bekannt, dass bei Erzeugung von Kammwollgarnen eine Spinnreserve von R_F=15 – 25% notwendig ist. Die Werte unter der unteren Grenze verursachen eine Steigerung des IFR (Index der Bruchfrequenz) im Spinnprozess. Mit experimental ermittelten Feinheitswerten (siehe Tabelle 1) sieht die Kalkulation wie folgt aus:

Tabelle 3

Ursprung der Wollarten	Feinheit der realisierten Garne	$n_{s\,min}$ Faser/ Querschnitt	$\overline{n}_s$ Faser/ Querschnitt	R_F %
Inländische Wolle (24 P)	Nm 36	40	55	37,5
	Nm 45	40	44	10,0
	Nm 52	40	38	–
Importwolle (70's)	Nm 36	40	67	67,5
	Nm45	40	54	35,0
	Nm52	40	46	15,0

Daraus ist zu bemerken:

– Beim Spinnen von Nm 36-Garnen hat die R_F hohe Werte in beiden Fällen. Trotzdem beobachtet man, dass (beim Spinnen) der IFR ca. 2 mal kleiner beim Spinnen der 70's – Wollarten, war.

– Beim Spinnen von Nm 45-Garnen, hat die R_F grössere Werte im Falle der Verarbeitung der 70's – Wollarten und hat Werte unter der unteren Grenze im Falle der Verarbeitung der 24 P – Wollarten. Zu bemerken ist es doch, dass diese gesponnen werden konnten, aber nur wenn die IFR-Werte grösser waren (um ca. 2,5 grösser).

– Beim Spinnen der Nm 45 – Wollarten, Importfasern verarbeitend, war der Spinnprozess möglich, aber diesmal hatte der IFR hohe Werte.

4.2. Was die Eigenschaften der realisierten Garne anbelangt. Beim Erzeugung von Nm 36 – und Nm 45 – Garnen sowohl bei der Verwendung inländischer Wollarten, als auch importierter Wollarten, haben die erzielten Garne physische- mechanische Eigenschaften, die den Uster- Normen und -Normativen entsprechen. Zum Beispiel sind die Werte für Uster-Ungleichmässigkeit, für Zugfestigkeit und für Defekte (dicke, dünne Garnstellen, Knötchen), unter 50%.

Die aus Importfasern erzeugten Garne verzeichnen trotzdem grössere Werte im Vergleich zu den Garnen, die aus 24 P – Wollarten erzeugt wurden, und zwar was die Ungleichmässigkeit bei der Bruchlast, die Uster-Ungleichförmigkeit und die Defekte anbelangt.

Schlussfolgerung:

Die Fasern aus 24 P – Wolle können entsprechend gesponnen werden für Erzielung der Garne bis Nm 45. Zugleich gibt es auch die Möglichkeit, dass sie entsprechende physische- mechanische Eigenschaften haben sollen.

4.3. Hohes Qualitätsniveau der inländischer Wollarten gegenüber den Importwollarten. Die Ergebnisse einiger vertieften Forschungen (elektronische Mokroskopie, chemische Analysen) haben folgendes hervorgehoben:

– Die Schuppen haben veränderliche Grössen, Formen und Dimensionen, weichen von der senkrechten Lage ab und haben die Tendenz die freien Ränder zu entfernen;

– Bei den Importwollarten, in der Orthokutikulären Zone, beobachtet man einen erhöhten Gehalt von disulfiden Bindungen (kleiner Kontrast zwischen Ortho- und Parakortex);

– Bei den rumänischen Wollarten gibt es einen stark heterogenen Charakter sogar in parakortex;

– Die rumänischen Wollarten im allgemeinen sind armer an disulfiden Bindungen und reicher an Lentionin, haben kurzere und also starrere Bindungen (in den Veredelungsarbeiten verwandelt das Fixieren die disulfiden Bildungen in lenthioninsche Bildingen);

– Die Schafbockwolle ist fast ähnlich mit der Importwolle;

– Die Wollarten 70's haben eine grössere Elastizität und eine kleinere plastische Verformung im Vergleich zu den inländischen Wollarten.

Eingegangen am 7. Oktober 1997

Technische Universität „Gh. Asachi", Jassy, Lehrstuhl für Spinnerei und Weberei

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FILABILITATEA UNOR LÂNURI ROMÂNEŞTI (24 P) ÎN REALIZAREA DE FIRE FINE ŞI EFECTUAREA UNOR COMPARAŢII CU FIRE DE ACEEAŞI FINEŢE DIN IMPORT

(Rezumat)

Se propune analiza comparativă a prelucrării unor lânuri din ţară şi respectiv din import. Analiza rezultatelor privind caracteristicile calitative ale firelor obţinute, legată de analiza caracteristicilor de la care s-a pornit permit o serie de concluzii şi interpretări: în ceea ce priveşte valoarea vitezei de filare şi a modului de desfăşurare a procesului de filare; în ceea ce priveşte caracteristicile firelor realizate.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

DISTRIBUTION OF THE LENGTH OF FLAX FIBRES PROCESSED ON THE FIRST TYPES OF MACHINES FROM THE FLAX BUNDLE PREPARATION

BY

ADRIANA MUSTAŢĂ

The present paper analyses in detail the length distribution of the fibres delivered on the band-forming machine, on the doubling machine and the mixing drawing frame – the first devices from bundle's classical spinning preparation – versus the normal distribution. Thus, there have been calculated the asymetry coefficient, the vaulting coefficient and the coefficient of excess. This comparative analysis of distributions permits to reduce the additional irregularity introduced during drafting.

1. Introduction. Bast fibres – a category in which flax is included, too – are known as natural, technical fibres with quite a complex structure, which influences their properties and processability for textile domains to a considerable extent.

From the viewpoint of spinning, the length fibre, fineness, content of impurities and braking load are of special importance, as any adjustment, along with the intensity of processing in spinning mills depend on such characteristics. In classical spinning processes, flax fibres get shorter and thinnes after each stage of processing.

One of the causes inducing flax technical fibres shortening is detachment of the fibres, i.e. their individualization during intervention of the gill box from the rolling drawing train present in each of the machines on which classical spinning preparation. Breaking fibres in the drafting train of the machines of spinning preparation may also be caused by the simultaneous catching of some ends fibres between the pairs of the feeding and delivering rollers, delivery rate being much higher than the feeding one. Thus, the fibres whose length is at least equal with the rolling mill train's gange may be broken. In the preparation of classical spinning of liberian fibres, an operation in which shortening fibres and individualization is desired, a parameter such as the rolling drafting gange is adjusted to lower values than fibres' average length.

The present paper analyses in detail the length distribution of the fibres delivered on the band – forming machine, on the doubling machine and the mixing drawing frame – the first devices from the bundle's calssical spinning preparation – versus the normal distribution. This is one of the most important distributions of the probability theory, having been discovered by Carl Friedrich G a u s s (1777–1855). The curves of normal distribution are beel-shaped and are symmetrical to the Oy axis.

2. Materials and Methods. Evolution of flax technical length fibres in the spinning miel was followed with the following mixing receipt:

- scutched flax bundle – type II;
- scutched flax bundle – type III;
- scutched flax bundle – type IV.

Processing of the fibrous material assumed the classical flow characteristic for bundle's spinning, the bunches of scutched bundle being first combed on the vertical combing machine.

The machines utilized in the operating process from the delivery of which samples further subjected to analysis have been taken over are: the band – forming machine, the doubling machine and the mixing drawing frame. The average length of the delivered fibres on each shifting of the flow sheet was established by the standard method of individual measurements. This parameter, length of the flax fibres delivered by the machines of spinning's preparation, varies randomly and may be statistically investigated by means of distributions.

Generally, distributions differ one from another by their degree of asymmetry. A distribution's asymmetry is stronger, the higher is the difference between the aritmetical mean and the modulus length (distribution's dominant value).

In the present paper there have been calculated besides the localization parameters the aritmetical mean and the module the quadratic non uniformity and the asymmetry coefficient, the vaulting coefficient and the vaulting coefficient versus the normal distribution (the coefficient of excess).

The asymmetry coefficient may be defined as the ration between the square of the centered, third order moment, and the cube of the centered, second order moment, being calculated with relations:

$$\beta_1 = \mu_3^2(\mu_2^3)^{-1} \tag{1}$$

$$\mu_2 = \sum_{i=1}^{n}(x_i - x_{\text{med}})^2 n_i \left[\sum_{i=1}^{n} n_i\right]^{-1} \tag{2}$$

$$\mu_3 = \sum_{i=1}^{n}(x_i - x_{\text{med}})^3 n_i \left[\sum_{i=1}^{n} n_i\right]^{-1} \tag{3}$$

where: β_1 is the distribution's coefficient of asymmetry; μ_2 – centered, second order moment; μ_3 – centered, third order moment; x_i – length of fibre; x_{med} – average length of fibres; n_i – frequency of fibres with the same length.

In order to chack whether, in the case of the studied distributions, the values of length fibres are concentrated around the average level more than in the case of a normal distribution, the Karl Pearson vaulting coefficient was calculated with the following relation:

$$\beta_2 = \mu_4(\mu_2^2)^{-1} \tag{4}$$

where: μ_4 is the centered, fourth order moment, which may be calculated from relation:

$$\mu_4 = \sum_{i=1}^{n}(x_i - x_{\text{med}})^4 n_i \left[\sum_{i=1}^{n} n_i\right]^{-1} \tag{5}$$

For a normal distribution, the vaulting coefficient is three; it is noted by γ_2 and it may be calculated as:

$$\gamma_2 = \beta_2 - 3 \tag{6}$$

where: β_2 is the vaulting coefficient calculated for the distribution taken into study.

3. Results. Fig. 1 plots the length distributions of the flax fibres processed in the band - forming machine, doubler and in the mixing drawing frame - classical stages in the technological flow of bundle spinning.

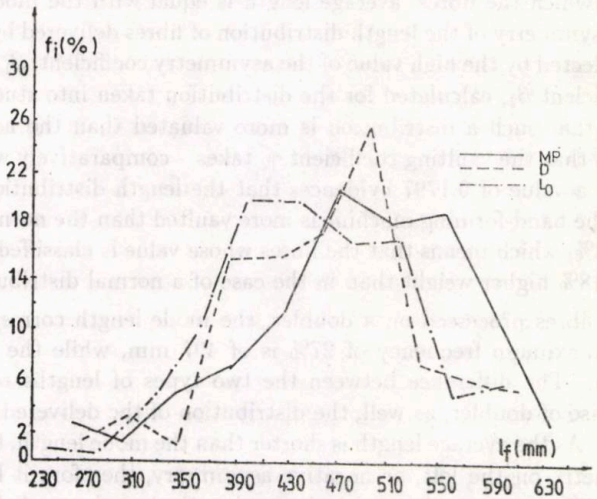

Fig. 1.- Distributions of the length of flex fibres delivered by the band forming machine - MP, doubler - D, and the mixing drawing frame - L_0.

Table 1 centralizes the main characteristics of the distribution shape for the length of fibres delivered by the band forming machine, doubler and mixing drawing frame - all involved the preparation of bundle's spinning.

4. Discussion. Analysis of the data from Table 1 evidences that the length of the flax technical fibres starts to decrease with the first passing from the bundle's spinning mill, as a result of the gill box intervention. A detailed study on the distribution of the fibres length along each stage proposed from the preparation of the bundle's spinning mill involves analysis of the diagrams of distribution of the delivered fibres length at each passage, as well as of the main parameters characterizing the shape of these distributions.

Table 1

Characteristics of the Distribution's Shape for the Length of Fibres Delivered by the Band Forming Machine, Doubler and Mixing Drawing Frame

No.	Name of passages	l_{mod} mm	l_{med} mm	σ	CV_1 %	β_1	β_2	γ_2
1	Band-forming machine	472	490	79.38	16.2	2.667	3.1797	0.1797
2	Doubler	497	463	81.95	17.7	0.0652	2.940	–0.06
3	Mixing drawing frame	440	447	78.67	17.6	0.0916	2.7488	–0.2513

In the case of the band-forming machine, the average length is higher than the mode length, thus the distribution of these fibres' length may be conventionally called distribution with asymmetry on the right or positive asymmetry, as the distribution evidences several high values, i.e. 52.5% represent fibres with higher length than the mode length, and less low values 27.5% representing shorter fibres than the mode length, comparatively with the normal distribution – which is perfectly symmetrical, a case in which the fibres' average length is equal with the mode length. The prononnced asymmetry of the length distribution of fibres delivered by the spreading machine is reflected by the high value of the asymmetry coefficient, β_1 i.e. 2.677. The vaulting coefficient β_2, calculated for the distribution taken into study is of 3.1797, which means that such a distribution is more valuated than the normal distribution. The fact that the vaulting coefficient γ_2 takes – comparatively with the normal distribution – a value of 0.1797 evidences that the length distribution of the fibres delivered by the band-forming machine is more vaulted than the normal distribution with about 18%, which means that the fibres whose value is classiffed to the average value have a 18% higher weight than in the case of a normal distribution.

As to the fibres processed on a doubler, the mode length corresponding to the class with a maximum frequency of 27% is of 497 mm, while the average length is of 463 mm. The difference between the two types of lengths reflects the fact that, in the case of doubler, as well, the distribution of the delivered length fibres is asymmetrical. As the average length is shorter than the mode length, the distribution shows asymmetry on the left, or negative asymmetry, therefore it has several low values, i.e. 46.7% represent fibres with shorter length than the mode length, and less high values, i.e. 19.5% are fibres with longer length than the mode length. Special mention should be nevertheless made of fact that, out of a total ratio of 46.7% fibres with shorter length than the mode one, only about 5% are shorte fibres, their length ranging between 250...360 mm. The coefficient of asymmetry β_1, calculated for the distribution of the fibres delivered by the doubler has a value of 0.065, which means that such a distribution has a slight negative asymmetry. The distribution diagram is less vaulted than the normal one, as the vaulting coefficient β_2 is of 2.94. Comparatively with a normal curve, the vaulting coefficient γ_2 calculated in this case takes a value of –0.06, thus the distribution diagram is less vaulted than the normal one with about 6%, the dispersion values increases and the curve becomes flatter and more extend than the normal one.

For the mixing drawing frame, the average length is higher than the mode length

(Table 1), while the length fibres distribution shows a slight positive asymmetry, the value of β_1 – the coefficient of asymmetry, being of only 0.019.

The calculated vaulting coefficient has a value of 2.748, which means that the values of length fibres are less concentrated around the level of average length then in the case of a normal distribution. The vaulting coefficient γ_2 takes – comparatively with a normal curve – a value of -0.251, therefore the distribution is less vaulted – versus a normal distribution.

A comparative analysis of the values of the three parameters, i.e. the coefficient of asymmetry β_1, the vaulting coefficient β_2 and the vaulting coefficient versus a normal curve β_2, if considering the distribution of the length of fibres produced by a mixing drawing frame and a doubler leads to the conclusion that the shape of the two distribution is similar.

5. Conclusions. For the first three passages in the preparation of the spinning bundle considered for the study, analysis of the values taken by the coefficient of asymmetry and coefficient of vaulting permits drawing of the following conclusions:

1° For the band-forming machine, the distribution of the yielded lebgth fibres is more vaulted than the normal distribution, which means that, out of the whole amount of fibres, a higher number of them has a length clases to the average value – comparartively with the normal distribution.

2° After processing of these fibres on the doubler and on the mixing drawing frame – both of them assuring bands' uniformization through doubling and mixing of fibres, as a result of the gill box intervention, and also of the decreasing ganges from the drawing train – breaking fibres occur, which causes a higher and higher dispersion of the length fibres, in parallels with the distribution curves' flattening. This phenomenon is reflected by the value of the vaulting coefficient versus a normal curve, i.e. 0.1797 for the distribution of the length of fibres produced by the band-forming machine, and, respectively, -25.1 for the distribution of the length of fibres processed on the mixing drawing frame. This means that, for the mixing drawing frame, the curve with 25.1% is more plat than the normal distribution. At the same time, the observation is made that, with the spreading machine and the doubler, the asymmetry of the length distribution of the yielded fibres is negative, the mode length being higher than the average length. As a result of breaking fibres the length distribution of fibres prouced on the mixing drawing frame shows a slight positive asymmetry, or asymmetry on the right, the fibres' average length being approximately 2% higher than the mode length.

The values recorded for the coefficient of asymmetry, coefficient of vaulting and coefficient of excess permit a comparative analysis of distributions, versus the normal distribution. Thus, a structural characterization of the rows of fibres may be realized, which permits to establish the gange of the rolling drawing train, the forces pressing on the cylinders and the value of the draft, thus continning shortening of the technical fibres through breaking of those bigger, than the gange, and reducing the additional irregularity introduced during drafting. Adjustment of these parameters is essential, as the continous breaking of falx fibres on the machines utilized in the preparation of

the bundle's spining may increase the ratio of short fibres which are shifted beyond any controll in drafting processes inducing irregularities.

Received, February 18, 1998

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DISTRIBUŢIA LUNGIMII FIBRELOR DE IN PRELUCRATE PE PRIMELE MAŞINI DIN PREPARAŢIA FILATURII FUIORULUI

(Rezumat)

Se face analiza repartiţiei lungimii fibrelor de in debitate pe primele maşini din preparaţia filaturii clasice a fuiorului comparativ cu distribuţia normală. În acest scop se calculează coeficientul de asimetrie, coeficientul de boltire şi coeficientul de exces.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

UNTERSUCHUNGEN HINSICHTLICH DES ZUSÄTZLICHEN FADENVERBRAUCHES BEI DER WEBKANTENHERSTELLUNG MIT UNKONVENTIONELLEN WEBMASCHINEN

VON

I. CIOARĂ und LUCICA CIOARĂ

Der Beitrag bezilht manche vergleichende Untersuchungen von unterschiedlichen Webkanten, die durch Webtechnologien mit Greifer, Luft- und Wasserstrahl hergestellt werden vom Standpunkt des zusätzlichen Fadenverbrauchs aus.

1. Einleitung. Die unkonventionellen Webtechnologien (mit Greifer, Projektil, Luft- und Wasserstrahl) weisen bei der Webkantenherstellung spezifische vom Schussträgertyp und vom angewandten Webkantenbildungssystem auferlegte Eigentümlichkeiten auf.

Die Webkanten müssen daher den strukturellen und technologischen Anforderungen in allen Fällen gerecht werden, damit unter den Verhältnissen der Gewährleistung deren Festigkeit und Widerstand während der späteren Bearbeitungsprozesse ein sehr beschränkten Schuss- und Kettfadenverbrauch erlangt werden kann. Manche Aspekte hinsichtlich der erforderlichen kinematischen, technologischen und strukturellen Bedingungen für die Webkantenherstellung sind an [1], [2] behandelt. Mein Beitrag bezilht sich auf manche vergleichende Untersuchungen von unterschiedlichen Webkanten, die durch Webtechnologien mit Greifer, Projektil, Luft- und Wasserstrahl hergestellt werden vom Standpunkt des zusätzlichen Fadenverbrauchs aus.

Die herstellungsmodalitäten der Webkanten mit den Hauptbauarten von unkonventionellen Webmaschinen haben das Bestehen folgender Besonderheiten an den Tag gebracht: -*Fransenkanten*: auf der Greiferwebmaschine (G) sind für jede Maschinenseite je zwei Spulfäden, die die tatsächliche Kantenverstärkung durch Dreherbildung sichem und je zwanzig eingehende Rollenfäden nötig; sie bilden einen sich ablösenden aber selbständig ausammehenden falschen Rand aus und gelten als technologischer Verlust; auf die Wasser- oder Luftstrahl Webmaschine (J_W, J_L) erfordert für jede Maschinenseite je zwei einführende Spulfäden, die die Kanten durch Dreherbindung befestigen; der aus 4-6 zusätzlichen Kettenfäden bestehende falsche Rand, der auf der Düse gegenüberliegenden Maschinenseite ausgeführt wird, löst sich ab und stellt technologischer Verlust dar; *Webkanten mit Umkehrenden*: auf der Projektilwebmaschinen (P) bedarf man kainer zusätzlichen Kettenfäden für die Kantenbildung.

2. Die Berechnung des zusätzlichen Fadenverbrauches. Die Webkantenerziehung auf unkonventionellen Webmaschinen bringt einen zusätzlichen Schuss- und Kettenfadenverbrauch mit sich, der mit der folgenden Beziehung berechnet werden kann:

$$C_{sb} = c\frac{2l_m}{l_{fb}} \times 100 \qquad (\%) \tag{1}$$

wo: l_m die Kantenbreite, cm; l_{fb} die Schussfadenlänge bei einem Eizug, cm,

$$l_{fb} = l_{us} + 2l_m \qquad (cm) \tag{2}$$

l_{us} die Kettenbreite in dem Webkamm, cm; c die simultanausgeführte Webstückeanzahl darstell darstellt.

Aus den Beziehung (1) und (2) ergibt sich die Abhängigkeit des Zusatzfadenverbrauches im Schussgam von der Kantenbreite, die jeder Webtechnologie eigen ist, sowie von der Breite im Webkamm und von der simultan realisierten Webstückanzahl. Auf die Projektilwebmaschine beträgt die Webkante 1.7 cm und c ist 1, 2 oder 3 während auf der Webmaschinen mit Greifer und mit Wasser- und Luftstrahl c=1, l_m=5 cm sind. In Berücksichtigung dieser Werte für c und l_m, sowie für die Kettenbreite im Webkamm l_{us}, die jeder Webtechnologie spezifisch ist, kann mit der Beziehung (1) der in der Abb. 1 gezeigte zusätzliche Fadenverbrauch im Schuss C_{sb} berechnet werden.

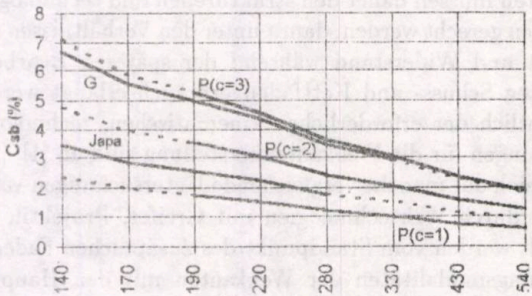

Abb. 1.– $C_{sb}=f(l_m, l_{us}, c)$

Die Grapfikanalyse der Abb.1 hebt folgende Aspekte hervor:

– bei allen betrachteten Webmaschinen wurde festgestellt, dass der zusätzliche Fadenverbrauch im Schuss bei geringen Webkantenlängen der grösste ist; er beträgt 6.66% auf der Greiferwebmaschine mit l_{us}=140 cm, 3.44% auf der Wasserstrahlwebmaschine mit l_{us}=140 cm und 1.75% (c=1), 3.51% (c=2), 5.27% (c=3) auf der Projektilwebmaschine mit l_{us}=190 cm;

– die Vergrösserung der Arbeitsbreite der Webmaschine hat die Veringerung des Zusatzverbrauches im Schuss zur Folge, und zwar: die zunehmende Arbeitsbreite von 140 cm bis 280 cm führt eine Abnahme des erwähnten Verbrauches C_{sb} mit 93% auf der Greiferwebmaschine und mit 96.5% auf der Jetwebmaschine herbei, während

die steigende Arbeitsbreite der Projektilwebmaschine von 190 cm bis 540 cm eine 3.8 fache Einschränkung des Zusatzverbrauches abgesehen von der simultan realisierten Webstückanzahl mit sich bringt;

– bei der gleichen Schussbreite im Webkamm, l_{us}=220 cm und c=1, ist C_{sb} um 2.85 bzw. 1.95 mal grösser auf der Greiferwebmaschine (4.39%) im Vergleich zu den Projektilwebmaschinen (1.52%) sowie zu den Webmaschinen mit Wasserstrahl (2.22%);

– auf der Projektilwebmaschine mit der gegebenen Kettenlänge im Webkamm l_{us} verdoppelt sich bzw. verdreifacht sich der Zusatzverbrauch für c=2 und c=3; die Werte des Zusatzverbrauches im Schuss sind bei dem simultanen Weben von drei Webstücken um 3.3 – 6.8% grösser im Vergleich zu den auf der Greiferwebmaschine registrierten Beträgen für die gleiche Nutzbreite im Webkamm;

– auf Webmaschinen mit gegebener Breite ermöglicht die Identität der bearbeiteten Gewebebreite im Webkamm mit der maximalen Arbeitsbreite der Maschine einen minimalen Zusatzverbrauch im Schuss; die nur teilweise verwendete Arbeitsbreite führt zur Vergrösserung der technologischen Verluste, so dass bei dem Weben auf Maschinen mit der Nennbreite von 220 cm von Webstoffen mit der Kettenbreite im Webkamm von 190 cm einen steigenden zusätzlichen Fadenverbrauch von etwa 15% festgestellt wurde.

Die Zusatzverbrauch von Kettenfaden C_{su} bei den Webkantenbildung, die der Technologien mit Greifer und Wasser- oder Luftstrahl spezifisch ist, wird mit der folgenden Beziehung kalkuliert:

$$C_{su} = \frac{2n_{sm}}{2n_{sm} + P_u l_{us}} \times 100 \quad (\%) \tag{3}$$

wo: n_{sm} die zusätzliche Anzahl von Randkettenfäden; P_u die Kettenfadendichte, Fäden/cm; l_{us} die Kettenbreite im Webkamm, cm, darstellt.

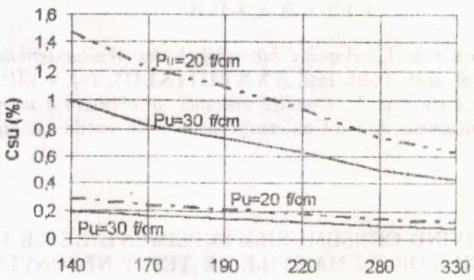

Abb. 2.– $C_{su}=f(l_{us}, P_u)$

Die Beziehung (3) zeigt die Einflüsse der zusätzlichen Anzahl von Randkettenfäden n_{sm} auf den zusätzlichen Verbrauch C_{su} je nach der Modalität der Webkantenherstellung in Abhängigkeit sowohl von der Kettfadendichte P_u als auch von der Kettenbreite im Webkamm l_{us}. Mit den Parametem n_{sm}, l_{us} und P_u entsprechenden wurde der C_{su} berechnet, der in der Abb. 2 dargestellt wird. Die Analyse der Kurvenvariation von C_{su} zeigt folgendes:

– C_{su} weist eine Abweichung zwischen 1.47 – 0.42% bei der Greiferwebmaschine und zwischen 0.28 – 0.08% auf der Maschine mit Wasserstrahl auf, während die Kettenlänge im Webladen zwischen 140 – 330 cm variiert;

– das Niveau des zusätzlichen Verbrauchs in der Kette wird von der Kettfadendichte P_u des bearbeiteten Artikels beeinflusst; die zunehmende Kettfadendichte von 20 bis 30 Fäden/cm ruft die Einschränkung des Zusatzverbrauches in der Kette um etwa 50% hervor;

– die Beibehaltung des zusätzlichen Fadenverbrauchs C_{su} unter 1% ist für die Ketten mit $P_u > 30$ Fäden/cm oder für die Kettenbreite $l_{us} > 200$ cm möglich.

3. Schlussfolgerungen. 1° Die Webstoffherstellung mit unkonventionellen Webtechnologien (mit Greifer, Projektil, Wasser- oder Luftstrahl) führt einen Zusatzverbrauch von Ketten- und Schussfäden herbei.

2° Bei den untersuchten Webtechnologien wurde der grösste Zusatzverbrauch im Schuss (0.66 – 7.1% auf der Projektilwebmaschine, 1.8 – 6.66% auf der Greiferwebmaschine, 0.9 – 3.44% auf der Maschine mit Wasser- und Luftstrahl) und der geringste in der Kette (0.4 – 1.47% auf der Greiferwebmaschine und 0.08 – 0.28% auf der Webmaschine mit Wasserstrahl) festgestellt.

3° Die Beibehaltung des gesamten zusätzlichen Verbrauches (von Ketten und Schussfäden) auf ein verhältnismässig kleines Niveau (< 5%) ist nur für die Kettenbreiten im Webkamm $l_{us} > 220$ m möglich.

4° Die Beschränkung des zusätzlichen Fadenverbrauches kann auch durch die Verwendung von einer Kettbreite im Webkamm, die der Nennbreite der Webmaschine so nah wie möglish sein muss, erhalten werden.

Eingegangen am 10. Oktober 1997

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CERCETĂRI PRIVIND CONSUMURILE SUPLIMENTARE DE FIRE LA FORMAREA MARGINILOR PE MAŞINILE DE ŢESUT NECONVENŢIONALE

(Rezumat)

Se prezintă cercetări comparative ale marginilor ţesăturilor realizate pe tehnologiile de ţesere cu graifăr, proiectil, jet de aer şi apă din punctul de vedere al consumurilor suplimentare de fire.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

L'ÉTUDE DES PROPRIÉTÉS DES NONTISSÉS AIGUILLETÉS DE MATIÈRES RECYCLÉS (I)

PAR
MARIA ZAMFIR et FLORENTINA COSTACHE

Cet article traite l'influence du processus aérodynamique de formation de la nappe fibreuse et celui d'aiguilletage sur les propriétés générales, comme masse par unité de surface, coefficient de variation de la masse volumique, résistance et allongement à la rupture, ainsi que les propriétés à utiliser comme la composante élastique de retour et déformation totale à une compression statique.

Les expérimentations ont été effectuées corréspondant à un programme factorial et en utilisant l'agrégat AMIT (Roumanie).

Les résultats sont traités mathématiquement et statistiquement avec des interprétations technologiques. Les meilleurs paramètres de mise en oeuvre sont indiqués.

1. Généralités. Depuis quelques ans, les problèmes du recyclage des déchets textils sont abordés aux congrès, expositions et publications internationales. Les meilleurs déchets sont ceux-là de production parce qu'ils sont récupérables séparément, peuvent d'être facilement collectés, sont propres et possèdent en grande partie leur caractéristiques de départ [1], [3], [8].

Si on tient compte que les résources de matières textiles décroissent, mais leur prix augmente, alors la meilleure solution est celle-là de transformer les déchets de production en fibres effilochées.

À partir de là, un usage ultérieure en produits textils classiques, comme des fils ou des nontissés, est possible. Mais, on trouve de plus en plus des fibres effilochées dans les produits nouveaux comme fils ou tissus type coton ou type laine, dans des produits non textils, en fibres de rembourrage ou pour armer des plaques, des rouleaux, des pièces de constructions, etc. [1], [3], [7], [8].

Le processus qui précéde ou suit celui-là d'effilochage peut être décrit en quelques étapes [1]:

a) traitement préliminaire: nettoyage, sélection, élimination des corps étrangers, réduction en taille, mélange, ensimage et humidification, ouvrage de la structure textile;

b) effilochage avec des paramètres variables et réglables selon le type de déchets: en éliminant les bouts, dépoussièrage et une solution mécanique pour séparer les fibres afin ne pas endommager davantage les fibres par le passage dans les étapes d'effilochage ultérieures;

c) traitement ultérieur: dépoussièrage, mélange, garnettage, droussetage et

séparation.

L'industrie de nontissés utilise presque 30% du total des déchets textils [3], [8], auxquels les nappes fibreux se réalisent principalement par le principe aérodynamique et puis liées par aiguilletage ou chimiquement avec une pulvérisation des adhésives en état aqueux.

À partir d'une bonne ouvraison des fibres effilochées, qui doivent présenter une longueur et une finesse minimale, ainsi que un degré d'ouvraison, ceux-ci peuvent être usinées par aiguilletage en produits finals.

Pour les nontissés en voie sèche, le processus aérodynamique de formation d'une nappe fibreuse c'est très juste défini. Par ce processus ont été fabriqués, seulement aux Etats Unis, à la fin de 1990, environ de 49,3 milles tonnes nontissés.

Le processus aérodynamique permet à produire des structures de nappes fibreux auxquelles les fibres sont orientées en hasard, on dit aussi, „multiorientées", mais pour laquelle dans la littérature on trouve vraiment le terme de nappes fibreux „isotropyques" ou „pêle-mêle".

Cette technologie permet l'usage de n'importe quelle sorte de fibres, en finesse et en longueur, ainsi que celles-là effilochées, mais en conditions d'une certaine proportion des fibres courtes, moyennes et longues.

Les équipements actuels sont ceux-là de type Rando (Les Etats Unis), Fehrer et Angleitner (Autriche), Schirp (Allemagne), ou changements aux technologies de cardage, nappage et aiguilletage, comme par exemple Spinnbau Bremen, Hergeth Hollingsworth et Dilo (Allemagne), ou Asselin (France).

Un agrégat est aussi l'un nommé AMIT (Roumanie) représenté sur la Fig. 1, qui permet l'usinage de fibres effilochées pour des nontissés pré-aiguilletés.

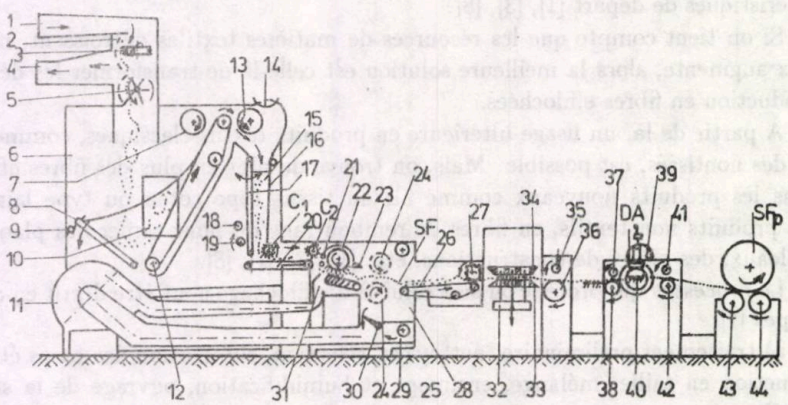

Fig. 1.– Schéma d'agrégat AMIT (Roumanie).

Cet agrégat contient: a) des éléments d'alimentage et de mélange à un loup cardeur; b) dépoussièrage; c) transport pneumatique du matériel fibreux; d) zone de repos technologique du matériel; e) contrôle mécanique de la masse du matériel fibreux dans la caisse d'agrégat (*1,...,10, 12,...,19*); f) dispositif à effilocher et de

formation aérodynamique de la nappe fibreuse à l'aide d'un cylindre-effilocheuse avec des pointes (C_1, C_2, *20,...,22, 11, 31, 23,...,27, 30, 28*); g) un ventilateur centrifug et deux cylindres pérforés (*11, 31, 24*); h) machine à pré-aiguilleter avec une simple planche à aiguilles montante (*32,...,36*); i) égalisateur de lisières (*37, 38, DA, 39, 41, 42*); j) rouleaux des nontissés (*43, 44*).

L'aiguilletage ne nécessite pas en général l'ouvraison des déchets jusqu'à la fibre individuelle [7], [10]. C'est juste, que le degré d'ouvraison conditionne le choix des conditions de travail à l'aiguilletage, donc d'un façon déterminante la qualité du produit final. Aussi, l'aiguilletage doit d'être effectué d'un tel façon avec un minimum d'aiguilles cassés.

Les applications des nontissés de fibres effilochées sont très diverses, comme par exemple: couvertures pour déménagements et pour les chevaux, épaulettes; industrie d'automobile comme isolation et remplissage ou en renforts, industrie du bâtiment pour isolation des toits, des murs, des conduits d'eau, nontissés pour sommiers/le rembourrage de linters de coton recyclé et mélange avec des produits tricotés recyclés en coton et acrylics, géotextiles pour drainage, matelas, support pour semences etc., [7].

Donc, les propriétés des nontissés sont aussi très diverses, ainsi que le même nontissé doit de correspondre à l'une ou aux plusieurs propriétés.

Si les applications et les propriétés des nontissés sont très diverses, alors que les processus d'usinage des déchets textils, ainsi que de transformation des fibres effilochées en nontissés doivent d'être étudiés plus détaillés que possible.

Pour cette raison, les interprétations statistiques, des données des essais, déterminent l'augmentation de la veridicité des résultats obtenus à la fin d'un tel étude.

2. Objectifs. Les objectifs de cet article ont été ceux-là d'étudier, en utilisant la programmation factoriale avec deux variables indépendantes, l'influence des paramètres du processus de formation aérodynamique de la nappe fibreuse de fibres effolochées soumise à l'aiguilletage, sur les propriétés des nontissés.

3. Experimentations. Pour expérimentations ont été utilisées des fibres effilochées de déchets de production de tricots acrylics, résultés au processus de coupage-couturage des details de vêtements et usinés par effilochage en utilisant l'agrégat Laroche type Olympic (France).

L'usinage des déchets textils à l'agrégat Laroche a été effectué correspondant à un programme factorial desquels résultats ont été présentés dans un autre article [2].

Les principales caractéristiques des fibres effilochées sont les suivantes: fibres effilochées (43,81%), segments de fils non effilochés (52,30%); segments de tricots non-effilochés (3,89%); longueur moyenne de fibre (52,98 mm); uniformité de la longueur de fibre par le coefficient de variation (46,96%); fibres courtes moins que 25 mm (19,4%); fibres moyennes entre 25 mm et 60 mm (57,2%); fibres longues plus que 60 mm et jusqu'à 120 mm (23,4%).

Les pourcentages des fibres en fonction de leur longueur ont été résultés en util-

isant la diagramme cumulative à la longueur de fibre.

Les variables dépendantes, qui représentent les propriétés des nontissés de fibres effilochées, ont été étudiées en utilisant un programme factorial, central, tournabil avec deux variables indépendantes [4], [5], [6], [9], [11].

Les variables indépendantes qui ont été considérées sont: x_1 – la vitesse d'alimentage du matériel fibreux au cylindre d'effilochage, exprimée en m/min; x_2 – la vitesse de sortir du nontissé pré-aiguilleté, exprimé en m/min.

On peut souligner les suivantes:

– La vitesse du matériel fibreux (x_1) détermine la quantité de fibres alimentées au cylindre à effilochage (*22*), ainsi qu'aux cylindres perforés (*24*); alors, elle détermine effectivement la masse par unité de surface de la nappe fibreuse résultée dans un processus aérodynamique;

– la vitesse de sortir (x_2) du nontissé détermine le temps passé par la nappe fibreuse dans la zone d'aiguilletage et par conséquence la densité d'aiguilletage.

Le programme expérimental avec les valeurs codifiées et réelles des variables indépendantes est présenté dans le Tableau 1.

Tableau 1

Le programme factorial et les variables dépendantes expérimentales

No. exp.	Variables indépendantes				Variables dépendantes	
	Codifiées		Réelles, [m/min]		Y_M	Y_γ
	x_1	x_2	x_1	x_2	g/m^2	%
1	–1	–1	0,33	3,3	381,500	9,927
2	1	–1	0,47	3,3	432,500	15,301
3	–1	1	0,33	4,7	346,840	9,944
4	1	1	0,47	4,7	444,840	8,367
5	–1,414	0	0,30	4,0	308,400	9,590
6	1,414	0	0,50	4,0	500,000	5,763
7	0	–1,414	0,40	3,0	477,068	15,880
8	0	1,414	0,40	5,0	327,410	9,284
9	0	0	0,40	4,0	399,827	6,800
10	0	0	0,40	4,0	388,017	6,375
11	0	0	0,40	4,0	390,127	6,845
12	0	0	0,40	4,0	386,212	7,230
13	0	0	0,40	4,0	392,714	6,960

Aussi, on peut noter que ne peuvent pas être considérées comme variables indépendantes, à cet agrégat, quelques paramètres technologiques. Mais, ils sont restés invariables à la durée des expérimentations aux valeurs suivantes: a) vitesse du cylindre à effilocher de 2760 rot/min; b) vitesse de frappe de la planche à aiguilles de 397 coups/min; c) vitesse du ventilateur centrifug de 1000 rot/min; d) la profondeur de pénétration des aiguilles dans la nappe fibreuse à une valeur de 10 mm [10].

On peut dire cette raison à cause que ces paramètres technologiques ne peuvent pas d'avoir cinq niveaux de variation, en correspondant à une programme factorial.

Dans la Partie I de cet article sont présentées seulement les recherchers sur les suivantes variables dépendantes: Y_M – la masse par unité de surface, exprimée en

g/m^2; Y_γ - l'uniformité de la masse volumique, déterminée par le coefficient de variation, exprimé en %.

Dans le Tableau 1 sont aussi présentées les valeurs expérimentales des variables dépendantes étudiées.

4. Resultats et interpretations. Les modèles (1) et (2) expriment mathématiquement les relations entre les propriétés des nontissés à analyser et le processus aérodynamique et d'aiguilletage:

$$(1) \quad Y_M = 391,477 + 52,490x_1 - 29,242x_2 + 5,881x_1^2 + 4,901x_2^2 + 11,75x_1x_2$$

$$(2) \quad Y_\gamma = 6,844 - 0,202x_1 - 2,03x_2 + 0,605x_1^2 + 3,057x_2^2 - 1,738x_1x_2$$

Dans le Tableau 2 sont présentées les valeurs calculées du Test Student [11], concernant le testage de signification des coefficients de régression à une probabilité de 95% et ϑ=4 degrés de libertés.

Tableau 2

Le testage des coefficients de régression

Y_i	Test Student. Valeurs calculées pour:						Valeur théorique
	b_0	b_1	b_2	b_{11}	b_{22}	b_{12}	
Y_M	164,900	27,968	-15,581	2,922	2,435	4,427	α=0,05
Y_γ	49,374	-1,841	-18,528	5,143	26,003	-11,212	ϑ=4
							t_{tab}=2,1

L'adéquation des modèles mathématiques en utilisant aussi le Test Fisher-Snedecor, ainsi que les valeurs des coefficients de corrélation multiple R_{Yx_1,x_2} et leur testage avec le même test, sont présentées dans le Tableau 3.

Tableau 3

Le testage des modèles mathématiques et coefficients de corrélations multiple

Variables dépendantes	Adèquation des modèles	Coefficient de corrélation multiple		Coefficient de détermination
	F_c	R_{Yx_1,x_2}	F_c	d_{Yx_1,x_2}
Y_M, [g/m^2]	5,6139	0,9065	23,04927	0,821742
Y_γ, [%]	9,62066	0,9466	43,10069	0,89605
Valeurs du test Fisher-Snedecor	ϑ_1=ϑ_2=12 α=0,05 F_t=2,69	f_1=2; f_2=10 α=0,05 F_t=4,1		

On peut constater que les modèles mathématiques (1) et (2) expriment justement le processus à analyser pour une probabilité de 95%.

Dans les Figs. 2 et 3 sont représentées graphiquement les modèles mathématiques résultés à l'étude.

La masse par unité de surface Y_M est influencée directement par la variable indépendante x_1, c'est à dire la vitesse d'alimentage du matériel fibreux au cylindre d'effilochage, mais seulement pour une vitesse constante du ventilateur centrifug.

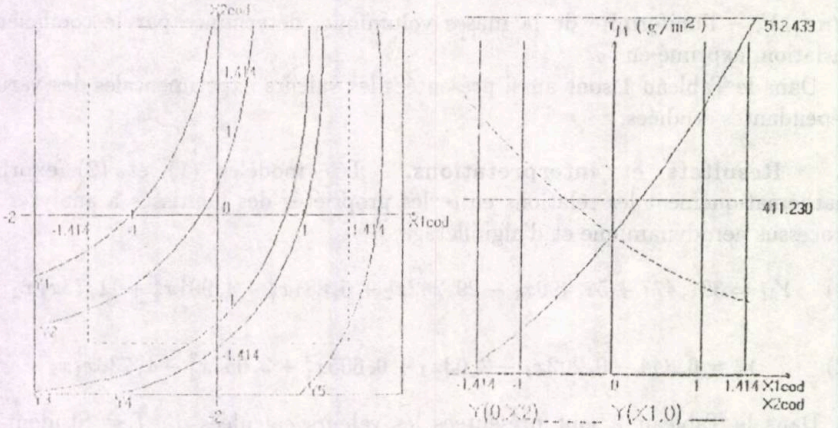

Fig. 2.– La variation de la masse par unité de surface (Y_M).

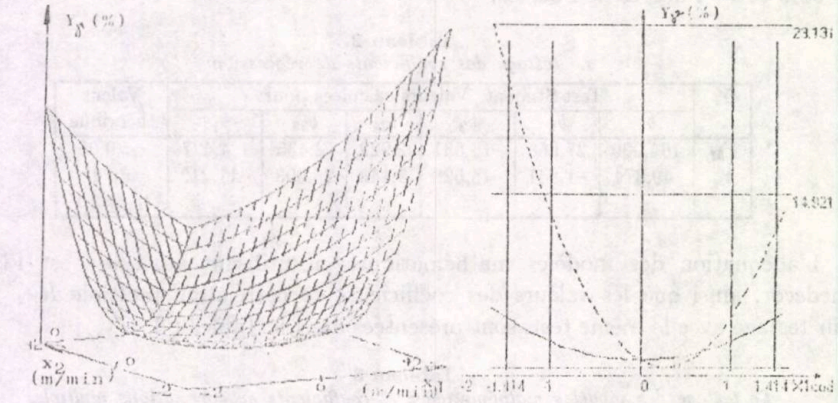

Fig. 3.– La variation du coefficient de variation de la masse volumique (Y_3).

Donc, un plus de matériel alimenté détermine l'augmentation de la masse du nontissé. L'augmentation de la vitesse de sortir du nontissé x_2 détermine un laminage supplémentaire au nontissé et par conséquence la réduction de la masse par unité de surface.

Le point stationnaire c'est un minimum situé à l'extérieur du domaine expérimental. Les surfaces de réponse notées sur les graphiques (Y_1 à Y_5) sont de valeurs: 346,84; 381,5; 432,5; 444,84 et 500 g/m^2.

Généralement, pour des sommiers comme rembourrage, on utilise les nontissés de masse 500 g/m^2, possible à réaliser avec les paramètres technologiques suivants: $x_1 \in (1{,}00...1{,}7)$ et $x_2 \in (-2...+2)$, codifiés; $x_1 \in (0{,}47...0{,}52)$ m/min et $x_2 \in (2{,}3...5{,}4)$ m/min en valeurs réelles.

La masse volumique peut représenter un indicateur total à deux propriétés comme la masse de surface et l'épasseur. Quand il s'agit de fibres effilochées c'est mieux

d'analyser le coefficient de variation de la masse volumique noté Y_γ duquel modèle mathématique (2) c'est un volume parabolique ellipsoïdal avec un point de minimum (Fig. 3). Ce point peut d'être considéré comme un point d'optim technologique de coordonnées: x_1=0,87 et x_2=0,562 en valeurs codifiées; x_1=0,456 m/min et x_2=4,393 m/min en valeurs réelles, corréspondant à un coefficient de variation de 5,659%.

Cette variable dépendante Y_γ n'est pas influencée fortement par la vitesse d'alimentage du matériel fibreux, mais elle décroit avec l'augmentation de la vitesse de sortir du nontissé.

5. Conclusions. Pour obtenir des nontissés de fibres effilochées avec des propriétées à utiliser demandées, il faut d'étudier tous les aspects, comme les paramètres d'influence, l'analyse statistique d'un nombre grande des essais etc.

En utilisant la programmation factoriale, des modèles mathématiques de II-ème degré et en traçant les surfaces de reponse de niveau constant on peut obtenir les meilleurs intervalles des paramètres de mise en oeuvre nécessaires aux valeurs maximales des propriétés.

Reçue le 4 avril 1997

Université Technique „Gh. Asachi", Jassy,
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STUDIUL PROPRIETĂŢILOR MATERIALELOR TEXTILE NEŢESUTE, CU CONŢINUT DE FIBRE RECUPERATE, REALIZATE PRIN INTERŢESERE (I)

(Rezumat)

Este prezentat un studiu al influenţei parametrilor procesului de formare aerodinamică a stratului fibros şi preconsolidare prin interţesere pe agregatul tip AMIT (România) asupra proprietăţilor materialelor textile neţesute realizate din 100% fibre recuperate din materiale textile refolosibile tehnologice. Rezultatele de optimizare obţinute sunt tratate matematic şi statistic şi insoţite de interpretări tehnologice.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

CONTRIBUTIONS CONCERNING THE DIAMETERS DETERMINATION OF 100% COTTON YARNS FOR KNITTING

BY

LILIANA MANEA, VALERIA GRIBINCEA and PERICLE SUFIŢCHI

The obtaining of some tricots with pre-established properties according to their destination requires to know and to establish the connection between the product's and raw materials properties.

There were studied the cotton yarn's diameters in free state F, [mm], and in stretched state f, [mm], in the fineness range Nm 40...Nm 70.

There were established the regression equations for calculation of the yarns' diameters F, [mm], f, [mm], according to their fineness and twist degree.

1. Introduction. In the functional and technological designing of knitwear it's necessary to know the cross dimensions of processing yarns, which are currently indicated by their diameter.

The knowledge about the precise values of yarns' diameters in free and stretched state assures:

– the rational exploitation of the machinery and the best preserve of yarns' quality, by establishing the correlation between yarns' fineness and machine's gauge;

– the decrease of errors in the calculations of the functional and technological designing;

– the decrease of deviation between the designed values and the real values of the structural and technological parameters.

The yarns' diameter is determined by a complex of factors as: the nature and properties of the raw material, the plain spinning process, the spinning system, the geometrico-structural characteristics of the yarn.

The calculation of the yarns' diameters is currently made taking into account a simplificatory assumption: the yarn is considered to be as cylindric and homogeneous, with a density ρ, [g/cm^3]. From the defined relations about the fineness, it can be calculated the yarns' diameters in free state F, [mm], and stretched state f, [mm]:

$$F = \frac{c_1}{\sqrt{Nm}},\ [\text{mm}]; \qquad f = \frac{c_2}{\sqrt{Nm}},\ [\text{mm}]$$

where $c_{1;2} = 2/\sqrt{\pi\rho_{1,2}}$ represents a coefficient with values which are depending on the specific mass of the yarn and nature of raw material.

2. The Experimental Part. From the same type of cotton fibre, on the spinning machine ring there were produced 20 variants of yarns in the fineness range Nm 40...Nm 70, with the twist degree $\alpha_m 70 ... \alpha_m 130$ (Table 1); for these yarns there were determined the values of diameters in free and stretched state.

Table 1
Assortments of Obtained Yarns

No.	Fineness, [Nm]	Twist degree					Raw material
1...5	40	70	85	100	115	130	100% carded cotton
6...10	50	70	85	100	115	130	100% carded cotton
11...15	60	70	85	100	115	130	100% carded cotton
16...20	70	70	85	100	115	130	100% combed cotton

The physical and mechanical characteristics of the cotton fibres which constituted the raw material of the yarns are presented in the Table 2.

Table 2
Physical and Mechanical Characteristics of the Cotton Fibres Used for the Obtained Yarns

No.	Characteristic		U.M.	Determined values	
				carded cotton	combed cotton
1	Fineness		Nm	7,580	
2	Breaking strain		cN	4.2	
3	Staple length	average	mm	30.25	30.85
		modal	mm	35.5	33.51
		spinner	mm	39.3	38.41
4	Relative humidity		%	6.2	5.1
5	Staple fibres (under 15.5 mm)		%	11	5.49

For the practical determination of the diameter, we used microscopical methods, with the application of a preliminary tension of 0.5 cN/tex (for the yarn diameter in free state F, [mm]) and 15% breaking strain (for the yarn diameter in stretched state f, [mm]).

The investigations vised:

– the fineness and the influence of twist degree study on the 100% cotton yarns' diameter values;

– the determination of the c_1, c_2 coefficients' variation limits for the analysed yarns;

– the elaboration of some nomograms that can offer the possibility to determine the diameters' values of 100% cotton yarns;

– the establishing of the calculation relations for the yarns' diameters in free and stretched state, which must contain the influence of the twist degree and of the fineness.

From the series of the diameters' values in free and stretched state accordingly to the different variants of the yarn, there were eliminated the aberant values applying the Grubbs test.

It was tested the random character of the polling data which were obtained and it was checked the distribution normality.

On the base of diameters and fineness of yarns' measured values, there were calculated the real values of the c_1, c_2 coefficients (for 100% cotton yarns, these coefficients have the unique values c_1=1.25, c_2=0.92 – in the speciality literature).

3. Results and Interpretations. The experimental data offered the possibility to elaborate a nomogram which allows accurate diameters' values determination of 100% cotton yarns in the range Nm 40...Nm 70 and the twist degrees which are included in the limits $\alpha_m 70 ... \alpha_m 130$. The 100% cotton yarns in the fineness and twist range which was studied are frequently used to produce the knitwear on machines with great diameter.

For an easier utilisation of the nomogram, the following specifications are made:

– for a 100% cotton yarn which has a fineness indicated in Nm and the twist degree α_m, it will be drawn (for the respective fineness) a parallel to the ordonate until this will intersect the corresponding parabole to the respective intersection;

– knowing the c_1 and c_2 values for the studied yarn, through the prolonging of the parallels to the abscissae axis (from the quadrants I and IV) and their intersection with the paraboles which describe the correlation $c_1 = f\ (F, [\text{mm}])$ and $c_2 = f\ (f, [\text{mm}])$, it will be read the values of the diameters in free and stretched state, on the abscissae axis from the quadrants II and III.

Depending on the parameters which are considered for the 100% cotton yarns Nm 40...Nm 70, with the twist degrees in the range $\alpha_m 70 ... \alpha_m 130$, the coefficients' values are framed in the intervals: $c_1 \in (1.1508; 1.2832)$; $c_2 \in (0.799; 0.9388)$.

Fig. 1.– Nomogram for the determination of 100% classic cotton yarns' diameter.

For the same yarns, there were determined the correlations:

$$y_1 = f(x_1, x_2); \quad y_2 = f(x_1, x_2); \quad y_3 = f(x_1, x_2); \quad y_4 = f(x_1, x_2);$$

where: y_1 is the diameter of the yarn in free state F, [mm]; y_2 – the diameter of yarn in stretched state f, [mm]; y_3 – the coefficient c_1 for the calculation of the yarn

diameter in free state; y_4 – the coefficient c_1 for the calculation of the yarn diameter in stretched state.

The parameters' values y_1, y_2, y_3, y_4 were determined with equations of the form:

$$y = a_0 + a_1 x_1 + a_2 x_2$$

where a_0, a_1, a_2 represent the coefficients of the regression equations, which have the values presented in Table 3.

Table 3

The Coefficient Values of the Regression Equations

Coefficient	Independent variable			
	$y_1 = F$, [mm]	$y_2 = f$, [mm]	$y_3 = c_1$	$y_4 = c_2$
a_0	0.2559381	0.1743433	1.254913	0.8305433
a_1	-0.000205294	-0.000150747	-0.001503802	-0.001114174
a_2	-0.01282142	-0.000741438	0.001830687	0.002639757
p %	99.82	99.58	99.74	99.77
R	0.8956	0.9013	0.9235	0.9852

Table 3 contains: p – the probabilities (calculated with the Student test) that the independence between the considered variables should be described by a linear relation with the determined coefficients; R – the values of the correlation coefficients between the parameters which were studied.

The mathematical models which conduct to the determination of 100% yarns' diameters, when there are known the yarns' fineness and twist degree, are [2]:

$$y_1 = 0.2559381 - 0.000205294x_1 - 0.01282142x_2$$
$$y_2 = 0.1743433 - 0.000150747x_1 - 0.000741438x_2$$
$$y_3 = 1.254913 - 0.001503802x_1 + 0.001830687x_2$$
$$y_4 = 0.8305433 - 0.001114174x_1 + 0.002639757x_2$$

In order to check the signification of the coefficients of regression equations, it was used the Student test.

The comparison between the coefficients' values and the values accordingly to the 95% reliable level confirms the corestness of the experimental program.

A precise knowing of the yarn diameters' values can assure the premises for the preparation of a technical complete and correct documentation and the improvement of control norms' quality regarding the knitwear characteristics.

4. Conclusions. The studies represent original contributions regarding the way in which can be determined the diameters' values of 100% cotton yarns in free and stretched state, accordingly to their twist degree and fineness.

There were established the variation intervals of the c_1 and c_2 coefficients for the cotton yarns, in the range Nm 40...Nm 70, with the twist degrees $\alpha_m 70 ... \alpha_m 130$ [$c_1 \in (1.1508; 1.2832)$; $c_2 \in (0.799; 0.9388)$].

On the base of an original mathematical model, accordingly to the considered parameters, there were established the calculation relations for the c_1, c_2 coefficients and the 100% cotton yarns' diameters in free and stretched state.

Received, February 23, 1998

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CONTRIBUŢII PRIVIND DETERMINAREA DIAMETRELOR FIRELOR 100% BUMBAC PENTRU TRICOTAJE

(Rezumat)

Obţinerea unor tricoturi cu proprietăţi prestabilite, în concordanţă cu destinaţia, presupune cunoaşterea şi stabilirea legăturii dintre proprietăţile produsului şi proprietăţile materiei prime.

Se prezintă rezultatele unui studiu referitor la diametrele în stare liberă F, [mm], şi întinsă f, [mm], ale firelor 100% bumbac, în gama de fineţe Nm 40...Nm 70.

S-au elaborat nomograme şi s-au stabilit ecuaţiile de regresie pentru calculul diametrelor firelor F, [mm], f, [mm], funcţie de fineţea şi gradul de torsionare ale acestora.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

NEW PRINCIPLE OF DOBBY MECHANISM OF LOOM

BY
JIŘI MRÁZEK

The dobby machine together with a shedding motion represents one of the most important parts of the machine dynamics. The contribution discusses the dynamics analysis of the system dobby-shedding motion heald shaft. There is analysed the dobby of new principle with using a spring clutch and the shedding motion with a stright motion mechanism. The behavior of the spring clutch was solved in an experimental way and its results formed unput quantities in a mathematic model of the whole shedding motion. The equations of motion were determined by means of the Lagrange equation of the second type. The result is represented by graphs of kinematic quantities on individual elements of mechanism in dependence on mass parameters (rigidity, moments of inertia) and on clearances in kinematic pairs of the mechanism. The solution is carried out by computers.

1. Introduction. Shedding motion with a dobby mechanism forms one of the basic mechanism of a loom, which ultimately decides the running speed and the quality of the fabric produced. Dobby mechanism and beat-up mechanism jointly influence the dynamic behavior of the machine as whole.

The main problem of presently used dobby mechanisms is ensuring greater reliability and longer working life of different parts. Since dobby mechanisms are used to weave complicated designs, they should be easily programmable. With ever increasing demand on higher speeds, there occurs dynamic problems especially due to functional clearances in putting the hooks on the lifting knife in Hatterslay system and due to clearances in other kinematic chains. Hence, in the last few yars, attemts have been made to replace this system by others like rotary, hydraulic, oscillating system, etc. These systems bring other problems in control part of the dobby, in ensuring 180° rotation of the main shaft and in hook engagement in pattern control mechanism, etc.

This paper attempts to analyse the dynamics of one of the many possible principles of the dobby mechanism. Dynamic characteristics should be studied taking into account all the machine parts like the drive, pattern controlling device, lifting mechanism and heald shaft, which affect the dynamics. The most important thing is the drive, i.e. ensuring 180° rotation of the main shaft and the nature and shape of the curves of kinematic values, which have a great influence on the heald shaft movement. On the contrary, it is impossible to evaluate a dobby mechanism without considering the lifting mechanism and heald shaft. Hence dynamic evaluation must be carried out for the whole system.

2. Working Principle of the Dobby. A simple four-bar mechanism *2,3,4* forms the basic pattern controlling mechanism of the dobby for individual heald shafts as shown in Fig. 1. This dobby is designed for 8 heald shafts and therefore cranks *2* (drive for pattern controlling mechanism) are fixed at an angular difference of 45° with respect to axis of the element *4*. Thus sufficient space for fixing crank *2* and its drive is obtained.

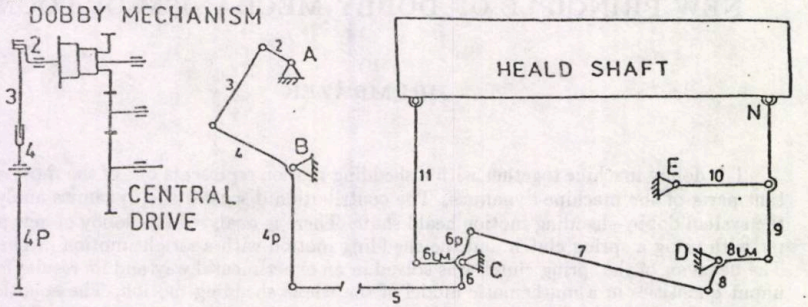

Fig. 1.– Pattern controlling mechanism.

The most critical problem in this principle is ensuring exactly a 180° rotation of the crank shaft *2*, because this rotation corresponds to the lifting of the heald shaft. For ensuring the drive precisely with a 180° rotation, a spring clutch type WARNER model A39 is used, which with the help of two springs ensures starting, transmission of power and stopping at the required position. Because of the principle that is used in the clutch, the starting and stopping position do not changes even due to wear (Table 1).

Table 1
Starting and Stopping Period of the Clutch

I, [kg m^2]	Starting time, [s]		Stopping time, [s]	
	rated speed reaching	damping time	zero speed reaching	damping time
0.012	0.07	0.20	0.05	0.19
0.030	0.13	0.27	0.05	0.21

3. Characteristics of the Spring Clutch. It is evident that nature of starting of the spring clutch will have significant influence on the characteristics of motion of the heald shaft. For the mathematical model to be discussed later, starting and stopping of the spring clutch are very much critical. Theoretical analysis can be carried out only with difficulties and with significant inaccuracies. The problem here is with the transmission of torsional moment using springs, which get tightened on the driven shaft of the clutch. The kinematic values depend on several factors like rigidity, transmitted torsional moment, friction coefficient between the spring and the shaft, speed of the clutch, etc. Figs. 2 and 3 show the angular velocity curve ω of the clutch with a loading equivalent to moment of inertia I_1=0.012.

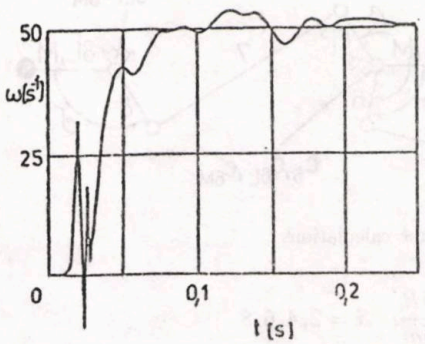

Fig. 2.– Angular velocity at the starting of the clutch.

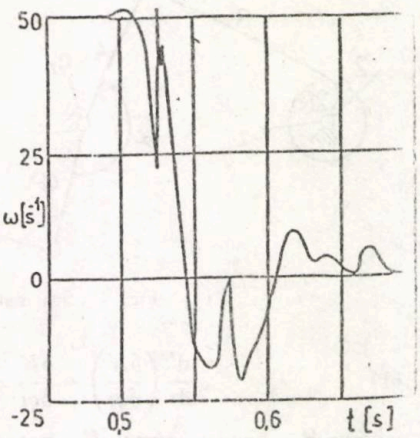

Fig. 3.– Angular velocity at the stopping of the clutch.

Table 1 gives the time required for starting and stopping for the selected input parameters. The values show that the starting and stopping depend very much on the loading. Vibrations due to starting and stopping are given by rigidity of the clutch and the extend of the starting phase of the mass.

Measurements were carried out at an angular velocity of ω=525 s^{-1}, which corresponds to the maximum velocity accuring in looms.

Measured period of starting and stopping and the angular velocity-time curve are not of required standard. For the given example, it should be noted that the values quoted here are for the extreme positions of the four-bar mechanism *2,3,4* (Fig. 1), which correspond to bottom and top dead centre. Effect on the heald shaft has been studie using mathematical model for the analysed system.

4. Mathematical Model of the System. To study experimentally the characteristics of the spring clutch, which is one of the important parts of the system, it is necessary to carry out dynamic analysis of the system according to Fig. 4. This system is a complicated one as for as the number of elements and the kinematic chains are concerned (Fig. 4). Mathematical model has been formulated with the following assumptions, where two heald shafts M and L are driven by a single mechanism *2,3,4*: a) mass of heald shafts M and L and elements *9,10,11* are reduced to the joints of the elements *6* and *8*; b) mass of elements *3,5,7* are replaced by two mass concentrated points and are considered as rigid; c) rocking levers of elements *2,4,6,8* are rigid and are mutually joined by torsional rods; d) clearances in kinematic chains are considered in elements *2,4,6* and *8*; e) viscous damping in individual elements is also considered in the model.

Equations of motion of the system are formulated using Lagrange's equation of the type II in the form:

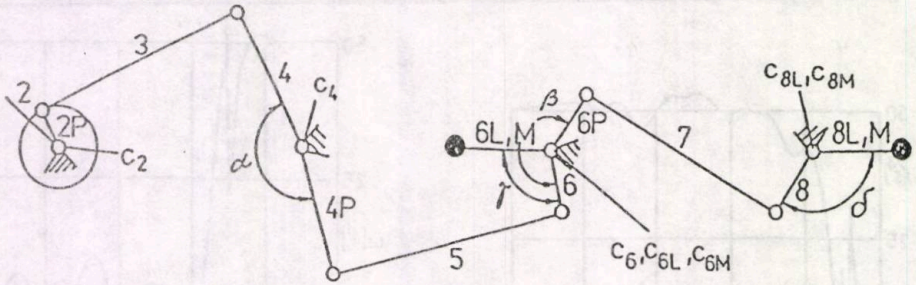

Fig. 4.– Schematic diagram for calculations.

$$(1)\qquad \frac{\mathrm{d}'}{\mathrm{d}t}\left(\frac{\delta K}{\delta qi}\right)-\frac{\delta K}{\delta qi}=-\frac{\delta U}{\delta qi}-\frac{\delta R}{\delta qi},\quad i=2,4,6,8$$

where: K – kinetic energy; U – potential energy; R – dissipative function.

$$\begin{aligned}
\ddot{\phi}_{2P}(I_{2P}+I_4\mu_{24}^2) &= -I_4\mu_{24}\nu_{24}\dot{\phi}_{2P}^2-C_2(\phi_{2P}-\phi_2)+C_4\mu_{24}(\phi_{4P}-\phi_4-\alpha)-\\
&\quad -k_2(\dot{\phi}_{2P}-\dot{\phi}_2)+k_4\mu_{24}(\dot{\phi}_{4P}-\dot{\phi}_4)\\
\ddot{\phi}_{4P}(I_{4P}+I_6\mu_{46}^2) &= -I_6\mu_{46}\nu_{46}\dot{\phi}_{4P}^2-C_4(\phi_{4P}-\phi_4-\alpha)+C_6\mu_{46}(\phi_{6P}-\phi_6+\beta)+\\
&\quad +C_{6L}\mu_{46}(\phi_{6L}-\phi_6+\gamma)+C_{6M}\mu_{46}(\phi_{6M}-\phi+\gamma)-\\
&\quad -k_4(\dot{\phi}_{4P}-\dot{\phi}_4)+k_6\mu_{46}(\dot{\phi}_{6P}-\dot{\phi}_6)+k_{6L}\mu_{46}(\dot{\phi}_{6L}-\dot{\phi}_6)+\\
&\quad +k_{6M}\mu_{46}(\dot{\phi}_{6M}-\dot{\phi}_6)\\
(2)\quad \ddot{\phi}_{6P}(I_{6P}+I_8\mu_{68}^2) &= -I_8\mu_{68}\nu_{68}\dot{\phi}_{6P}^2-C_6(\phi_{6P}-\phi_6+\beta)+C_{8L}\mu_{68}(\phi_{8L}-\phi_8-\delta)+\\
&\quad +C_{8M}\mu_{68}(\phi_{8M}-\phi_8-\delta)-k_6(\dot{\phi}_{6P}-\dot{\phi}_6)+k_{8L}\mu_{68}(\dot{\phi}_{8L}-\dot{\phi}_8)+\\
&\quad +k_{8M}\mu_{68}(\dot{\phi}_{8M}-\dot{\phi}_8)\\
\ddot{\phi}_{6L}I_{6L} &= -C_{6L}(\phi_{6L}-\phi_6+\gamma)-k_{6L}(\dot{\phi}_{6L}-\dot{\phi}_6)-M_{6L}\\
\ddot{\phi}_{6M}I_{6M} &= -C_{6M}(\phi_{6M}-\phi_6+\gamma)-k_{6M}(\dot{\phi}_{6M}-\dot{\phi}_6)-M_{6M}\\
\ddot{\phi}_{8L}I_{8L} &= -C_{8L}(\phi_{8L}-\phi_8-\delta)-k_{8L}(\dot{\phi}_{8L}-\dot{\phi}_8)-M_{8L}\\
\ddot{\phi}_{8M}I_{8M} &= -C_{8M}(\phi_{8M}-\phi_8-\delta)-k_{8M}(\dot{\phi}_{8M}-\dot{\phi}_8)-M_{8M}
\end{aligned}$$

Different parameters are indicated in Fig. 4.

In equations of motion, the following transmission functions are used:

$$(3)\qquad \underset{j}{\phi}=f_{ij}(\underset{ip}{\phi});\quad \omega_j=\mu_{ij}\omega_{ip};\quad \varepsilon_j=\nu_{ij}\omega_{ip}^2+\mu_{ij}\varepsilon_{ip};$$

where: i=4,6,8; j=2,4,6.

Clearances occurring in the kinematic pairs of the chains are replaced by angular differences of the elements *2,4,6* and *8* and they are incorporated into the model under the following conditions:

$$(4)\qquad \begin{aligned}
|\phi_{ip}-\phi_i|<\oslash_i &\Longrightarrow \phi_{ip}-\phi_i=0\\
\phi_{ip}-\phi_i>\oslash_i &\Longrightarrow \phi_{ip}-\phi_i=\phi_{ip}-\phi_i-\oslash_i\\
\phi_{ip}-\phi_i<-\oslash_i &\Longrightarrow \phi_{ip}-\phi_i=\phi_{ip}-\phi_i+\oslash_i
\end{aligned}$$

where: i=4,6,8; j=2,4,6.

Equations have been solved using Runge-Kutta method for input parameters of the given lifting mechanism with heald shaft. The position of the mechanism with

zero acceleration of element *4* and zero deformation of all elastic elements has been taken as the starting point during calculations. Coefficient of viscous damping has been calculated from logarithmic decrements on the basis of measurements in the lifting mechanisms. Force due to warp threads has also been considered in the model.

5. Results. The problem was solved in a numerical computer. Input parameters are characteristics of the spring clutch that were determined experimentally and the optimum mass and strength parameters were selected. The curves of kinematic values of different elements were evaluated giving importance to quite movement of heald shaft. Fig. 5 shows acceleration curve for heald shaft. Since side heald shaft guide has been dispensed with and optimised mechanism *8,9,11* ensures a linear movement, movement of reduced masses on the elements $6L, 6M$ or $8L, 8M$ can be considered as the movement of the heald shaft.

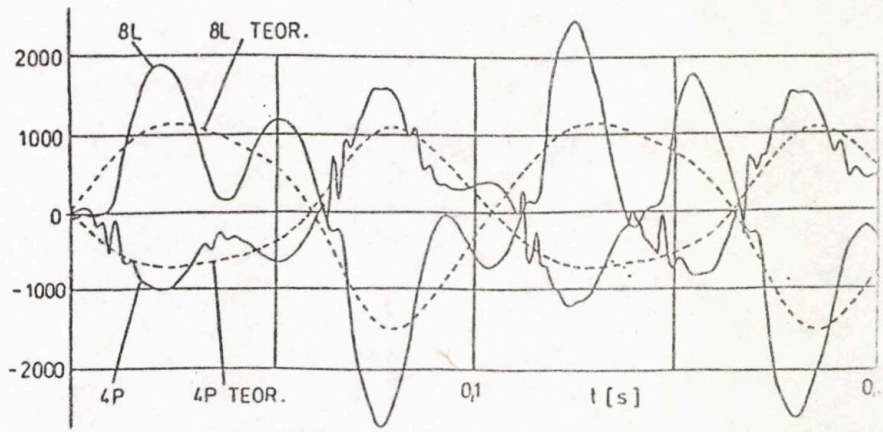

FIG. 5 ACCELERATION CURVE FOR HEALD SHAFT

Fig. 5.– Acceleration curve for heald shaft.

It can be started from the analysis that peak of acceleration curve are better for higher rigidity values of elements *6* and *8* and mainly that of elements *2* and *4*. Mass of heald shafts also helps in reducing the amplitude of the acceleration curve. Starting characteristics of the clutch has little efect only in the case of smaller values of mass of lifting mechanism and heald, i.e. where it leads to faster starting of the clutch (at zero or very small transmission ratio μ_{24}).

From the above results, the conditions for the production of spring clutches can be summarised as follows: a) it is necessary to ensure clearances within limit; b) it is necessary to ensure higher rigidity transmission of torque (between driving part of the clutch and the spring); c) it is necessary to use clutch with higher transmitted torsional moment; d) it is necessary to ensure a working life with engagement–disengagement cycle in the order of 10°.

Under these conditions, the spring clutch will be suitable to use in high speed

looms (around 1000 rpm).

Received, April 17, 1996

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UN NOU PRINCIPIU AL FORMĂRII MECANISMULUI URZELII

(Rezumat)

Se prezintă o analiză a dinamicii mecanismului de formare a rostului de la o maşină de ţesut. Modelul matematic utilizat se bazează pe ecuaţiile Lagrange, având ca date de intrare atât mărimi cinematice, cât şi dinamice. Pentru rezolvarea matematică au fost utilizate programe speciale.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

INTERACTIONS BETWEEN ACID DYES IN BINARY AND TERNARY MIXTURES WITHOUT FIBROUS MATERIAL

BY

AURELIA GRIGORIU, GEORGE-ERVANT GRIGORIU* and ELENA CÎDU

This paper presents a spectrophotometric method to measure the interactions between acid dyes and auxiliaries in the absence of the fibrous material.

1. Introduction. A simple way to measure the interactions between dyes and possible auxiliaries used in dyeing is the spectrophotometric method [1], [2]. A graph of transmission or absorption of a dyes in a aqueous sample may have big drops of absorption with marked maximum points which is specific to a real sample; an absorption band with intermediate characteristics (diminished absorption), is specific to particles interactioning with one another to form fine dispersions.

For the dyes that are used frequently in practice, spectrophotometric description is necessary in order to esthablish the interactions in the bath in the absence of the fibre, that change the absorbance and the hue in the dyeing process.

2. Experimental. The purpose of this paper is to prove the interactions between acid dyes in binary and ternary mixtures, in the absence and in the presence of acetic acid.

There have been chosen 3 acid dyes from Nylosan (SANDOZ) sortiment frequently used:

* Nylosan Gelb N3RL – CI Acid Orange 67 (CI 14172)
* Nylosan Rot FRL – CI Acid Red 263
* Nylosan Blau N5GL – CI Acid Blue 280.

The spectrophotometrical curves in the vizible area have been recorded by the spectrophotometer Pye Unicam SP 800 UV-Vis in 400–800 nm range.

There have been used quartz cuves having the same optic way (usually 10 mm), for the same series of determinations.

Solutions containing 10 g/l dye and 20 g/l acetic acid were prepared and were diluted so that they should fit to the scale of the spectrophotometer (for the red color the concentration was 0.03 g/l and for the yellow and blue color 0.15 g/l).

When testing the action of the acetic acid on the colour, the solutions of the dye contained 0.2 g/l acetic acid.

The UV-Vis spectra were recorded for the following solutions of:

– unique dyes with and without acetic acid addition;

– binary mixtures in additive alternative (association of two cuves with different dyes);

– interactive variant (physical mixtures of dyes);

– differential alternative (instead of water as a compensation solvent were used the solutions of dyes from the additive and interactive type used in turns as a withness sample and as a sample to be analyzed). The spectra of the ternary mixtures in the additive, interactive and differential type, with and without adds of acetic acid, were also recorded.

3. Results and Discussions. Table 1 presents the numbering of the spectra and of the figures where they are presented (Figs. 1...5).

Table 1

Dye	Adds		Spectrum number	Figure number
Red	– without acid		*1*	1
	– with acid		*2*	
Yellow	– without acid		*3*	
	– with acid		*4*	
Blue	– without acid		*5*	
	– with acid		*6*	
Red+Yellow	– without acid	– additive	*7*	2
		– interactiv	*8*	
		– differential	*9,9'*	
	– with acid	– additive	*10*	
		– interactiv	*11*	
		– differential	*12,12'*	
Red+Blue	– without acid	– additive	*13*	3
		– interactiv	*14*	
		– differential	*15,15'*	
	– with acid	– additive	*16*	
		– interactiv	*17*	
		– differential	*18,18'*	
Yellow+Blue	– without acid	– additive	*19*	4
		– interactiv	*20*	
		– differential	*21,21'*	
	– with acid	– additive	*22*	
		– interactiv	*23*	
		– differential	*24,24'*	
Red+Yellow+ +Blue	– without acid	– additive	*25*	5
		– interactiv	*26*	
		– differential	*27,27'*	
	– with acid	– additive	*28*	
		– interactiv	*29*	
		– differential	*30,30'*	

Comparing absorption spectra of the unique acid dyes (Fig. 1) in the presence and in the absence of the acetic acid we can observe that the highest influence of the acid is on the yellow dye (spectra *3* and *4*); absorption decreases in the presence of the acetic acid because of the change in the ionization equilibrium and of the possibility to appear ion–molecule associations. A lower influence can be noticed on the red dye (spectra *1* and *2*) but on the blue one it is almost inexistent (spectra *5* and *6*).

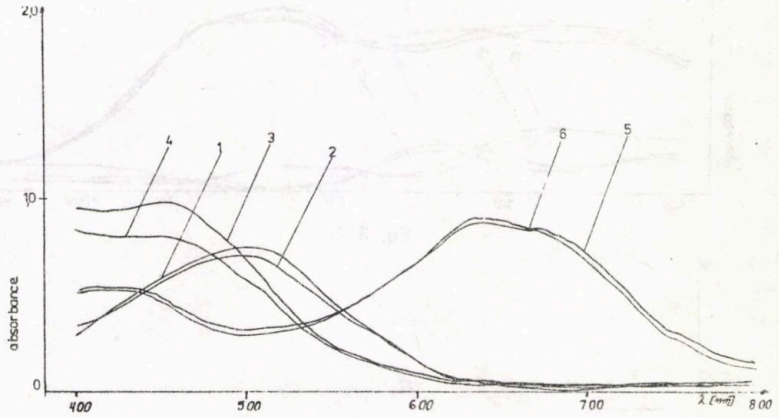

Fig. 1

In the binary mixtures of red and yellow dyes (Fig. 2) and yellow–blue (Fig. 4) one can see a decreased absorption because of the acid that influences more in the additive mixtures (spectra *7, 10, 19, 22*) than in the interactive ones (spectra *8, 11, 22, 23*).

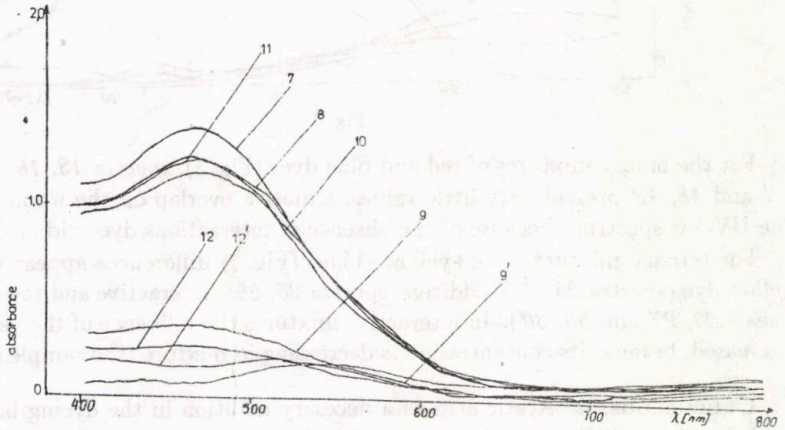

Fig. 2

Differential spectra are influenced by the acid as well as by the interactions of the dyes that are more intense in the mixtures containing yelow dye (spectra *12, 12', 24, 24'*).

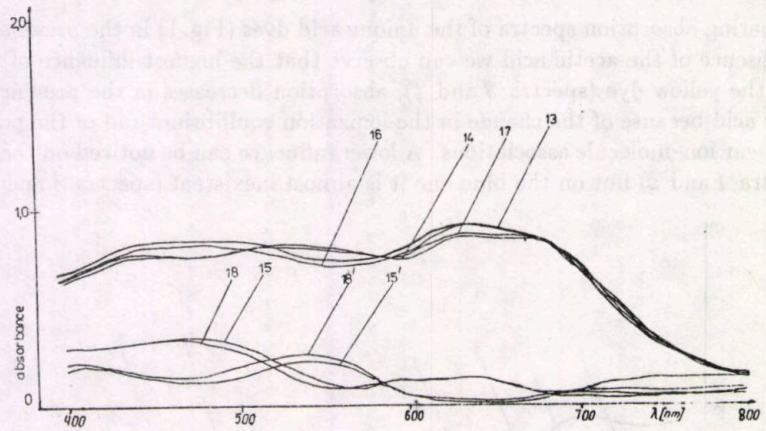

Fig. 3

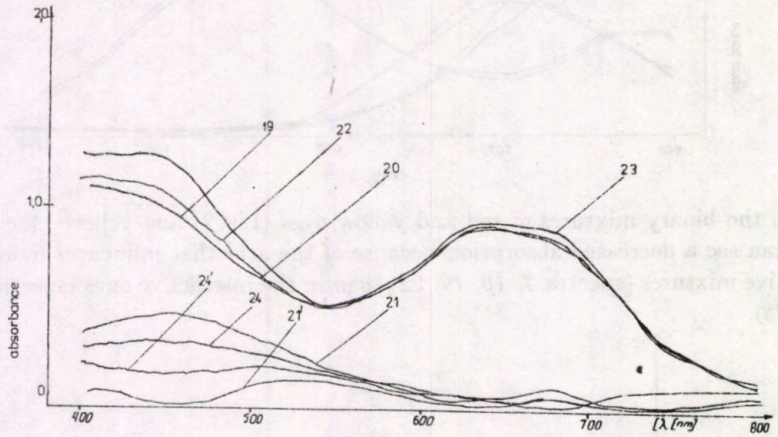

Fig. 4

For the binary mixtures of red and blue dyes (Fig. 3), spectra *13, 16; 14, 17; 15, 5'* and *18, 18'* present very little values, almost a overlap on the whole domain of he UV-Vis spectrum because of the absence of interactions dye-acid or dye-dye.

For ternary mixtures (red+yellow+blue) (Fig. 5) differences appear due to the ellow dye (spectra *25, 28* – additive; spectra *26, 29* – interactive and the differential nes – *27, 27'* and *30, 30'*). In interactive mixtures the influence of the yellow dye is ecreased, because its concentration is decreasing in mixture (the sample is diluted).

. **Conclusions.** 1° Acetic acid as a necesary addition in the dyeing baths of the cid dyes has a different influence on each dyes, more a intensive one, on Nylosan elb FLG dye and a less intensive influence on Nylosan Red FGL and Nylosan Blau 5GL.

2° In the binary mixtures of the three acid dyes the presence of the acid decreases he absorption for the mixtures where it is present. The mixture of red and blue does

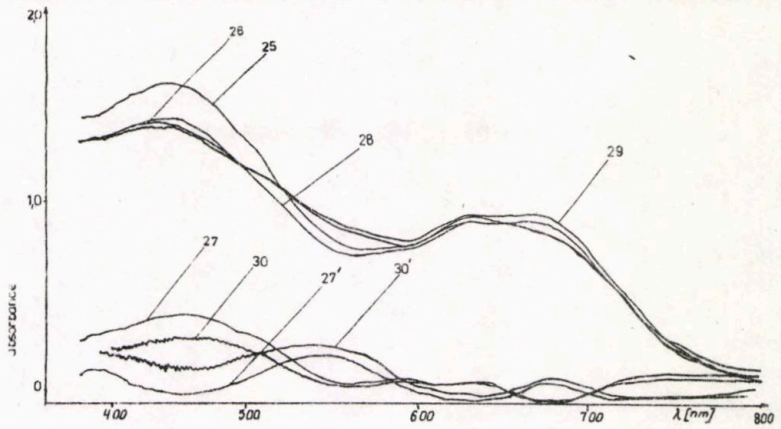

Fig. 5

not have differences in any type of interaction (additive, interactive and differential).

3° The ternary mixture has the same difference in the decrease of the absorbance because yellow dye is present.

Received, September 10, 1996

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INTERACŢIUNI ÎNTRE COLORANŢI ACIZI ÎN AMESTECURI BINARE ŞI TERNARE ÎN ABSENŢA MATERIALULUI TEXTIL

(Rezumat)

Se prezintă o metodă spectrofotometrică de apreciere a interacţiunilor între coloranţii acizi şi auxiliarii de vopsire în absenţa materialului fibros.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

BINDING CHARACTERISTICS OF ACID VIOLET 90 AND DIRECT RED 80 TO POLYCATIONS WITH QUATERNARY AMMONIUM SALT GROUPS IN THE MAIN CHAIN

BY

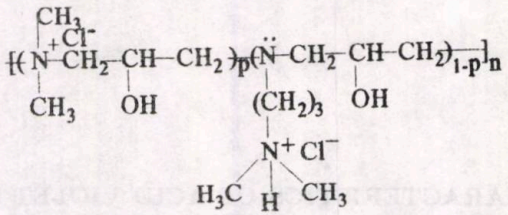
STELA DRĂGAN*, LUMINIŢA GHIMICI*,
AURELIA GRIGORIU and DIANA COMAN**

Formation of the polycation/dye complexes by the interaction between polycations with quaternary ammonium salt groups in the main chain and two anionic dyes with respective one and six sulfonic groups (Acid Violet 90 and Direct Red 80) was emphasized by UV-Vis spectrometry. Polycations (PC_1 and PC_3) were different by their content in (N,N-dimethyl-2-hydroxypropylene ammonium chloride) units and by the degree of branching.

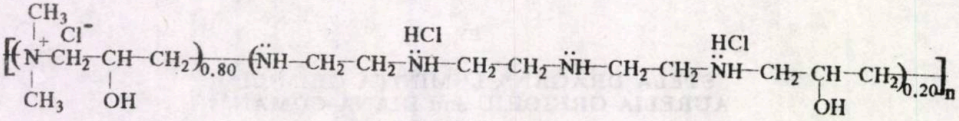
1. Introduction. The ability of the synthetic polyelectrolytes to change the environment of the small organic molecules is well known. Interaction of soluble polyelectrolytes with dyes regards mainly the influence of the structural characteristics both of the dyes and of the polyions on the following specific aspects: the thermodynamic parameters of the polyion-dye binding [1],...,[4], the removal of the dyes from water [5],...,[7], the improving the fibre dyeability [8], [9] and the light fastness of acid dyes [10] and so on. The binding of the anionic dyes to cationic polyelectrolytes was less studied.

In this paper, the interaction of two dyes having respective one and six sulfonic groups (Acid Violet 90 and Direct Red 80) to polycations with (N,N-dimethyl-2-hydroxypropylene ammonium chloride) units in the main chain was followed by UV-Vis spectrometry. The chromotropic properties of the used polycations were emphasized in a previous work [11]. The improving of wash fastness of some substantive dyes used for dyeing cotton and also of the light fastness of some acid dyes used for polyamide fibres, when the above mentioned polycations were used as cationic reagents, was already remarked [12].

2. Experimental. The polycations (PC_1 and PC_3) were synthesized by the condensation polymerization of epichlorohydrine with dimethylamine and a polyfunctional amine such as N,N-dimethyl-1,3-diaminopropane (polycation PC_1) and triethylenetetramine (polycation PC_3), according to the method presented in detail elsewhere [13], [14].



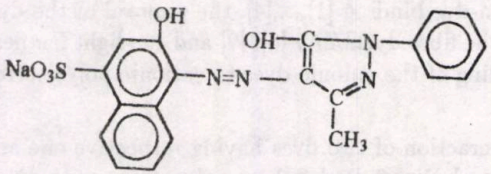
where: $p = 0.95$, polycation PC_1,



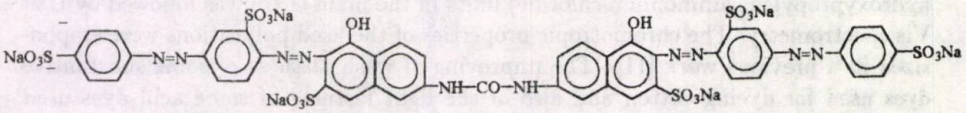
polycation PC_3
Scheme 1

Polycation samples were carefully purified by dialysis against distilled water until the absence of Cl^- ions in the external water was achieved. The diluted aqueous solutions were concentrated by gentle heating in vacuum, then the polymer was recovered by precipitation with acetone and finally purified with methanol/acetone as solvent/nonsolvent. Dried polycations were kept for a few days in vacuum on P_2O_5, ar room temperature and then characterized by the content of Cl_{ionic}, Cl_{total} and intrinsic viscosity in 1 M NaCl aqueous solution at 25°C: PC_1, Cl_{ionic} 23.22, Cl_{total} 23.58 and $[\eta] = 0.420$ dl/g; PC_3, Cl_{ionic} 23.84, Cl_{total} 23.83 and $[\eta] = 0.422$ dl/g. The concentration of all polymers means moles of charged sites per liter.

The structures of the dyes used in this work are included in Scheme 2.



Acid Violet 90



Direct Red 80
Scheme 2

The stoichiometry of the polycation/dye complexes was spectrometrically followed by recording the absorbtion spectra of a mixture between 10 ml of polycation aqueous solution with different concentrations and 10 ml of the dye aqueous solution with a concentration of about 5×10^{-5} M, P/D molar ratio being from 0 to 1000. All spectra were recorded after 30 min. of stirring, using a SPECORD M42 spectrometer (standard 1 cm quartz cell).

3. Results. UV-Vis spectrometry is the most used method to evidence the interaction between polyions and dyes. This supposes metachromatic properties of dye and chromotrope charactersitics of polymer.

To emphasize the influence of the polycation structure and of the sulfonic group number on the binding characteristics of the dyes above mentioned, the UV-Vis spectra for different P/D molar ratios were recorded (Figs. 1,...,5).

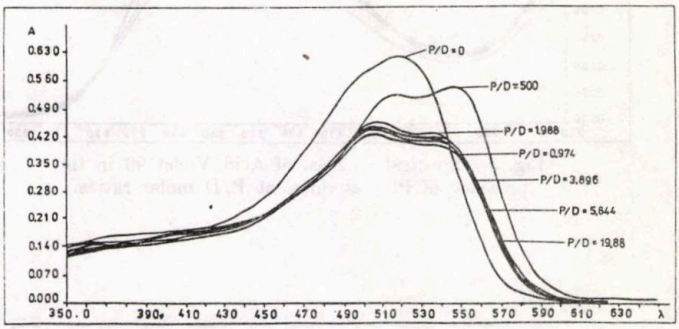


Fig. 1.– Spectral changes of Direct Red 80 in the presence of PC_1 at different P/D molar ratios.

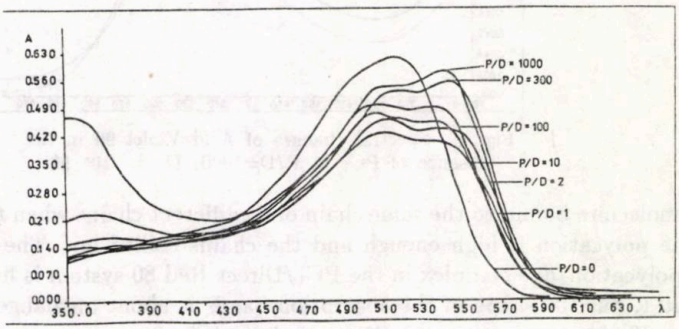


Fig. 2.– Spectral changes of Direct Red 80 in the presence of PC_3 at different P/D molar ratios.

Two new absorption maxima appeared in the UV-Vis spectrum for Direct Red 80 after the addition of the polycation PC_1: a hypsochrome shift at 505 nm and a batochrome shift at 542 nm compared with 521 nm, the characteristic maximum of the free dye (Fig. 1). The batochrome band is lower than the hypsochrome one, at P/D molar ratio from about 1 to about 20, but then the batochromic effect is higher than the hypsochrome band. The increase of the P/D molar ratio increased the batochrome maximum at 545 nm; even at P/D = 5000 this maximum had the same shape. That means the red shift is little influenced by the excess of the polycation and this behaviour could be brought about by the interaction between the

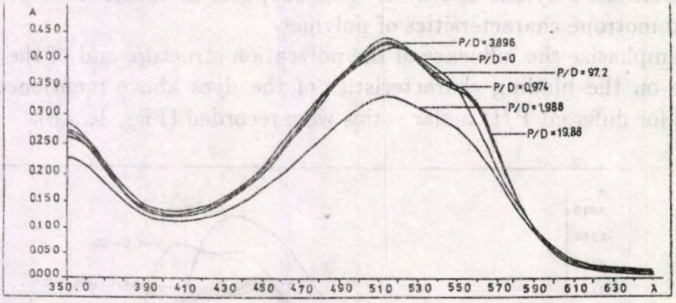


Fig. 3.– Spectral changes of Acid Violet 90 in the presence of PC_1 at different P/D molar ratios.

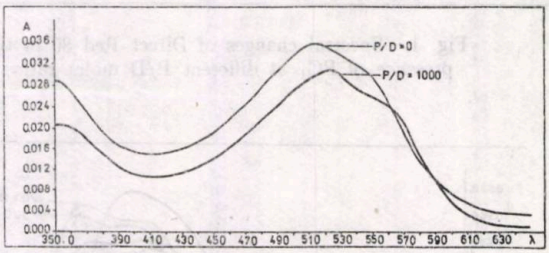


Fig. 4.– Spectral changes of Acid Violet 90 in the presence of PC_1 at P/D=1000; $D = 10^{-5}$ M.

dye molecules bound to the same chain or to different chains when the concentration of the polycation is high enough and the chains coilled up. The stoichiometry of the polycation/dye complex in the PC_1/Direct Red 80 system is first noted at P/D about 1, but the shape of the absorption bands is about unchanged until P/D = 6 (the sulfonic group number in Direct Red 80) (Fig. 6).

The decrease of the absorption maximum intensity for P/D = 1 was also observed in the PC_3/Direct Red 80 system, but the absorption maxima increase faster in this case with the increase of P/D molar ratio than for the PC_1/Direct Red 80 system (Fig. 2). For P/D molar ratio higher than 300, the spectrum shape is close to that of the free dye, although the hypsochrome (505 nm) and batochrome bands (542 nm) are still present even at P/D = 1000. Increasing the polycation content in the solution, the dye molecules are spreaded to a higher number of polycation chains according to dye stacking theory; the metachromatic bands intensity decreases in by increasing the polycation excess, this being a proof for the dye binding on the polycation. The faster return of the spectrum to that of the free dye, in the case of this system is caused by the branched structure of the polycation PC_3 (Scheme 1, the branching

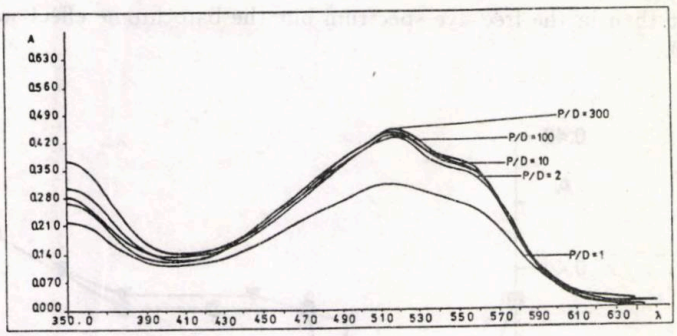


Fig. 5.– Spectral changes of Acid Violet 90 in the presence of PC_3 at different P/D molar ratios.

points being the secondary amine groups) and is an evidence for a more difficult dye-binding in this case.

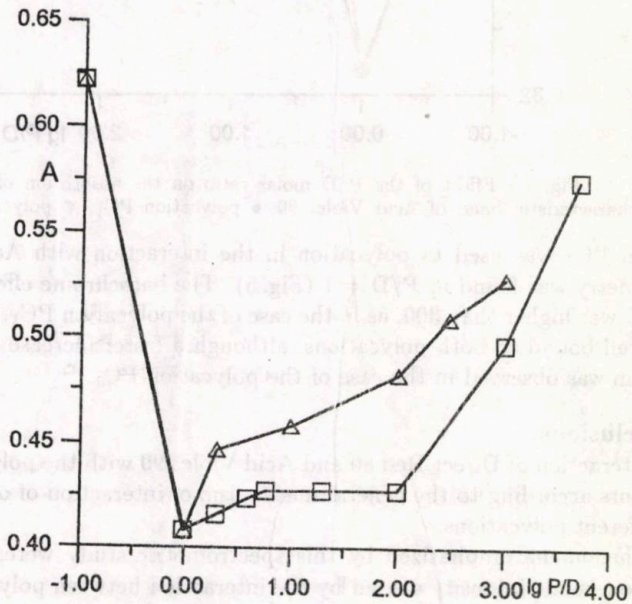


Fig. 6.– Effect of the P/D molar ratio on the absorption of the characteristic band of Direct Red 80: □ polycation PC_1, Δ polycation PC_3.

By the interaction between the polycation PC_1 and Acid Violet 90 a batochrome effect was emphasized, the stoichiometry clear at P/D about 2.0 (Figs. 3 and 7). From P/D = 2 to P/D = 1000 the absorption maximum increased and became

sharper than in the free dye spectrum but the batochrome effect was still present (Fig. 4).

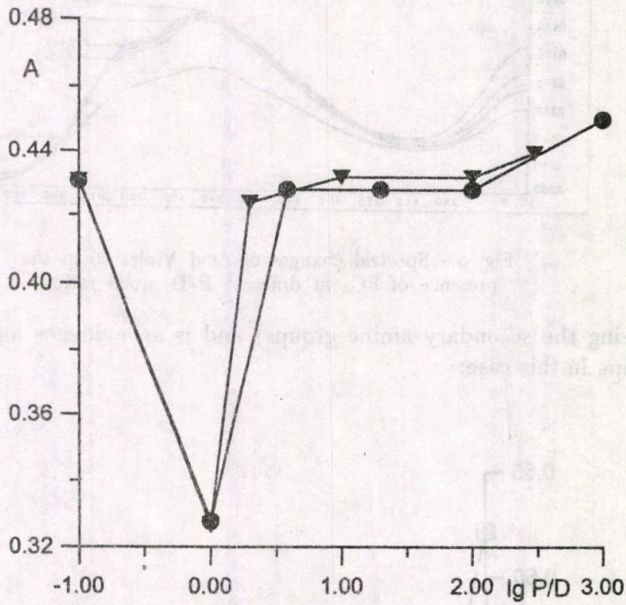


Fig. 7.– Effect of the P/D molar ratio on the absorbtion of the characteristic band of Acid Violet 90: • polycation PC_1, ▼ polycation PC_3.

When PC_3 was used as polycation in the interaction with Acid Violet 90 the stoichiometry was found at P/D = 1 (Fig. 5). The batochrome effect is also present whe P/D was higher than 300, as in the case of the polycation PC_1. It seems this dye is also well bound to both polycations, although a faster increase of the absorption maximum was observed in the case of the polycation PC_3.

4. Conclusions.

1° Interaction of Direct Red 80 and Acid Violet 90 with the polycations PC_1 and PC_3 occurs according to the general mechanism of interaction of other anionic dyes with different polycations.

2° Phenomena emphasized by this spectrometric study were: the decrease of absorption bands intensity caused by the interaction between polycations and dyes, batochrome and hypsochrome effects (metachromatic bands) because of the dye-binding on polyions, the evidence of the stoichiometry of the binding of dye to polycation.

3° The stoichiometry of the polycation/dye complex is evidenced from P/D = 1 to P/D = 10, for Direct Red 80 (6 sulfonic groups) and from P/D =,1 to P/D = 2, for Acid Violet 90 (2 sulfonic groups). The interaction between Direct Red 80 and

polycations PC_1 and PC_3 is stronger compared with Acid Violet 90 due to the higher number of sulfonic groups in the first case.

4° Polycation PC_3 has a higher content of amine groups that could induce a higher ability of this polycation to bind anionic dyes compared with polycation PC_1, but its branched structure is less efficient in this process.

Acknowledgements. The European Community (DG 12 – WRCA) is thanked for a research grant.

Received, May 8, 1998

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CARACTERISTICILE DE LEGARE ALE COLORANŢILOR VIOLET ACID 90 ŞI ROŞU DIRECT 80 DE CĂTRE POLICATIONI CU GRUPE CUATERNARE DE AMONIU ÎN LANŢURILE PRINCIPALE

(Rezumat)

Formarea complecşilor colorant-polication prin interacţiunea între policationii cu grupe cuaternare de amoniu în lanţul principal şi doi coloranţi anionici cu una şi respectiv şase grupe sulfonice (Violet acid 90 şi Roşu direct 80) a fost studiată prin spectrometrie UV-Vis. Policationii PC_1 şi PC_3 sunt diferiţi prin conţinutul lor în unităţi de sare cuaternară de amoniu şi prin gradul de ramificare.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

THE INFOFIN-CAD PROGRAM FOR TEXTILE FINISHING

BY

CORNELIU SAVENCU and AURELIA GRIGORIU

The paper presents the INFOFIN-CAD program for the textile finishing, having complex arborescent structure of interest for didactic and technical purposes.

The continous increase of the volume of information in the chemical processing of textile materials requires a thorough systematization, processing technological calculations and automatic storing of all data involved in the realization of the final products, which results in a considerable reduction of the time for their accessing and consultation.

All these considerations challenged us to elaborate an program, aimed, generally, at textile finishing informatization [1],...,[4]. The program has an open arborescent structure which permits its subsequent enrichement with additional data, collected in the course of finishing (Fig. 1).

Modularity is a main characteristic of this application; it is elaborated under the Windows platform, with a Sybase data system that is an SQL type language, while the way permitting communication with the data base system is Power Builder 5.0.

This is a visual medium, such as Visual Basic/Delpi or others, having a series of facilities, such as:

– a very simple and rapid communication with the data base;

– a unitary interface of the appliaction for users;

– a very simple-to-use application for users.

It is mono-user type application, which permits its independent running by each user, impeding any possible communication in the network, and assuring the access to an unique data base for several users.

A preponderent role in these programs is given to data bases. In recent years, two main tendencies have been evidenced among the numerous other ones, namely:

– data bases containing elements with a documentary character, in which the process of selection involves the items'denomination, subject, authors, a short abstract in key words and descriptors which represents actually a general presentation, no selection of the technico-scientific information being possible;

– data bases with a factual character, employed in the management of technological processes, computer-assisted design and research, administration of information, stocks, etc.

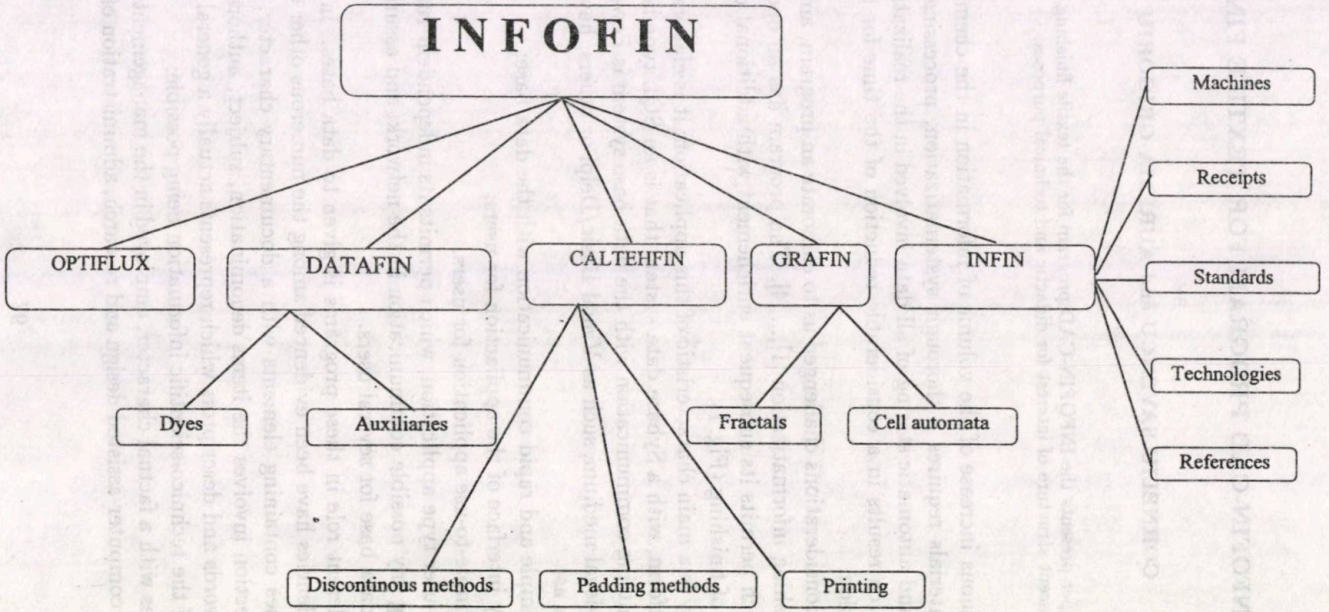

Fig. 1.- Arborescent diagram of the INFOFIN application.

The ever-increasing volume of information requires too, a longer time for their consultation, which imposed the elaboration, implementation and exploitation of some documentary data bases.

The problems expected to be solved with the program are:

1° Optimization of the "Opti-flux" finishing technology, which in its turn, includes other 3 subprograms of data bases in which they are introduced:

– the item's fibrous composition which includes the main types of fibres employed in the textile industry, taken either individually or in combinations in various ratios, the methods for their obtention, as well as their physical and chemical properties. This sub-program has a linear structure, which simplifies a lot the introduction, visualisation and modification of data, all elements considered being placed at the same level;

– the item's colour refers to its final "colour" (i.e. natural, semibleached, dyed, printed on a white or dyed background, etc.). The structure is arborescent (each of the initial colours being the "father" for another series of colours, up to the final level in which the coresponding colours are no longer "parents" for any other one);

– the item's destination is also arborescent, the initial destination becoming a "parent" for other series of destinations.

As a function of these three parameters – with which an item may be characterized, any type of technological flow (theoretical, applicative, other variants) may be obtained. This module actually represents one of the final objectives of our study, being composed of a single basic window. The first is always the most complete one, the other ones resulting from the modification of the order and number of operations (the theoretical flow does not always correspond with the practical one).

All flows resulted, as depending on the objective had in view, will be selected and copied on the printer.

2° Optimization of the technological calculations, "Caltehfin", for the establishment of the consumptions of chemical substances, dyes and of the treatments'costs, as well, is also subdivided into three subprograms:

– discontinous procedures;

– padding procedures (either semicontinuous or continuous);

– printing procedures.

Within such subprograms, several calculation variants may be applied – either simultaneously or separately (e.g., either with or without re-utilization of the working solutions, with or without previous impregnation of the textile material, etc.).

A comparison among the various procedures – for the selection of the most efficient and economic one – is also possible.

3° Realization of some "Datafin" data bases, including dyes (over 3,000) and chemical auxiliaries (over 1,000) – each with its characteristics. Vizualizations may be obtained, as a function of the class, country, company, C.I., a comparison being also possible between the dyes recommended for the obtention of the same colours.

The module calls applications in Fox-Pro, under a DOS platform.

4° Realization of programs that generate various types of random drawings, using either cellular automata of "Grafin" fractals.

An infinity of drawings may be obtained, in a quite multitude of variants (colours, comparison and simplification of theirs), white–black patterns being obtainable for each colour of the drawing, with the possibility of their direct photographing for printing machines.

This module permits running of three applications independent of the basic one, realized in other programming media and permiting image generation through various methods, such as:

– image generation through the fractals technique;

– image generation through various algorithms, starting from a series of primary images;

– image generation by the application of the cell automata theory.

5° The last set of programs, "Infin", permits the access to a series of information with a strictly technical character, related to the devices on which the technological operations are performed (classifications, building characteristics, working parameters and specific consumptions), on the internal standards that should be considered for the obtention of a feasible product, on the various receipts that may be applied in the realization development of a certian operation belonging to the flow sheet, on the bibliographical references consulted, recording the progress of the fundamental research and technology in the field of textile chemistry.

The global objective of the INFOFIN set of programs is both didactic – by making the future specialist acquainted with the computer, guiding him to a correct selection of the information from the numerous existing possibilities – and equally productive, for the introduction of the latest ideas – of both scientific and technical character – in industrial every day practice.

Received, June 15, 1998

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INFOFIN – PROIECTARE ASISTATĂ DE CALCULATOR ÎN FINISAREA TEXTILĂ

(Rezumat)

Se prezintă programul INFOFIN-CAD pentru finisare chimică textilă cu o structură complexă arborescentă care prezintă interes atât din punct de vedere didactic cât şi tehnico-ştiinţific.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

A STUDY OF THE COLOUR DIFFERENCES THAT OCCUR WHEN RECYCLING WASTE WATERS FROM PAD-BATCH REACTIVE DYEING

BY

ANDREI BERTEA and ROMEN BUTNARU

The paper presents a study of the colour differences that occur in the case of the recycling waste waters from the pad-batch reactive dyeing, after previous treatment with hydrogen peroxide in the presence of UV. The influence of the degree of recycling and of the number of recycling cycles on the position of the colour in the ANLAB space is determined.

1. Introduction. As energy resources are more scarce, and the cost of the effluent treatment is continually increasing, the recycling of the waste waters may prove to be a solution for those problems in the textile finishing industry [1],...,[7]. The possibilities of recycling the waste waters are the following:

– recycling without a previous treatment;

– effluent treatment in order to make possible the use of the treated water in some finishing technological processes;

– effluent treatment in order to make possible the use of the treated water in all finishing technological processes;

– recovering of some valuable chemical products.

The more frequently used are the first two, because the third method, which would be ideal from the ecological point of view, implies exceedingly big expenses.

There are many possibilities to recycle waste waters from reactive dyeing processes. In the absence of the discoloration, the waste can be used, in some conditions, to realise new dyeing processes on cotton or on polyamide. After discoloration, the treated effluent may be used for new dyeing or pre-treatment processes. Best opportunities to achieve industrial application have the processes that use decolorated waste waters to perform new reactive dyeing.

A possibility that proved to be effective in the recycling of the textile waste waters is the discoloration of the effluents, followed by their partial reuse for new dyeings. A previous paper analysed the possibilities to recycle wastes from cotton pad-batch dyeing, after a treatment with peroxide hydrogen in the presence of UV radiation [8]. Of great significance are the colour differences that occur when recycled water is used.

2. Experiments. We dyed a 100% cotton textile material with four reactive dyes: Reactive Red 45, Reactive Black 8, Reactive Orange 3 and Reactive Yellow 3 using the pad-batch technique:

- padding with 10 g/l dye, 10 g/l NaOH 38°Be and 25 g/l NaCl;
- squeezing to a squeezing degree of 70%;
- storing at room temperature for 24 hours.

The dyed material was washed off at 1:30 hydromodule, using 4 baths at 98°C and a fifth one at room temperature. None of the washing baths contained detergent.

The wastes from the first three washing baths were treated with hydrogen peroxide (1 ml/l and 3 ml/l) in the presence of the UV radiation and then used to perform new dyeing processes, recycling 50% of the treated water.

There have been used recycled water from a single dyeing or a mixture of waters from all the dyeings.

In order to evaluate the colour changes in comparison with a standard sample, we calculated ANLAB parameters for up to 5 recycles.

The shift in the ANLAB space in the case of the Reactive Red 45 is showed in Fig.1 for the use of unmixed waste waters and in Fig.2 for mixed waste waters. In both situations the figures represent the number of recycling cycles that have been performed.

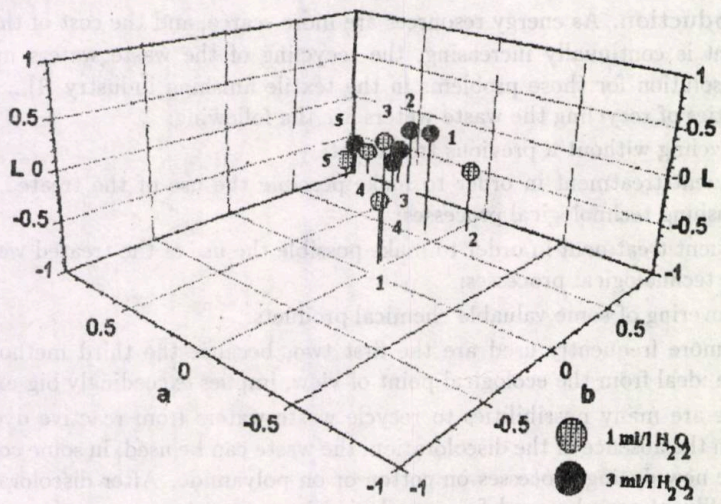

Fig. 1

It can be seen that colour changes are of minor importance, even when five recycling cycles are performed. There can be signalized a small shift of the colour towards yellow, especially after the third recycle. This changes are of less importance when it was used a concentration of 3 ml/l hydrogen peroxide for discoloration. It can be seen that in this situation the lightness of the samples is better. For the dyeings performed with mixed recycled waters more pregnant decreases in lightness appear, but ΔL does not descent below -1.

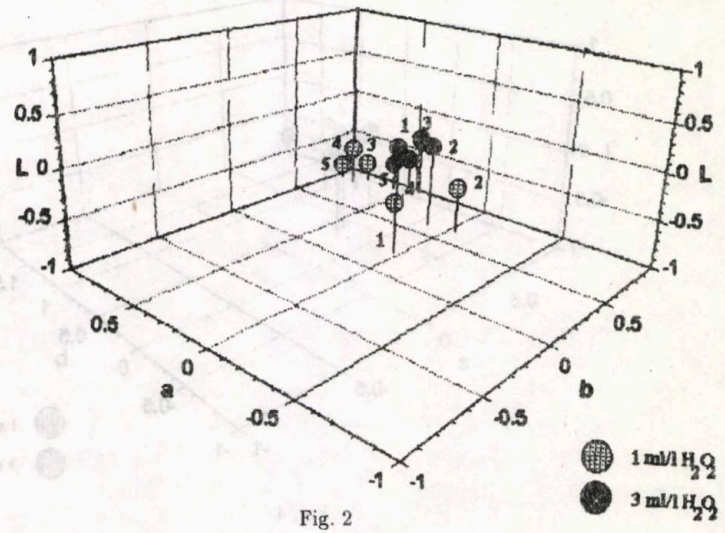

Fig. 2

From Figs.3, 4, that show the colour changes that occur when the dyeing is performed with 10 g/l Reactive Yellow 3, it can be seen that the colour is very slightly modified. The shift is to red, but insignificant. The lightness of the dyeing is modified, but this modification can not be discerned by visual means.

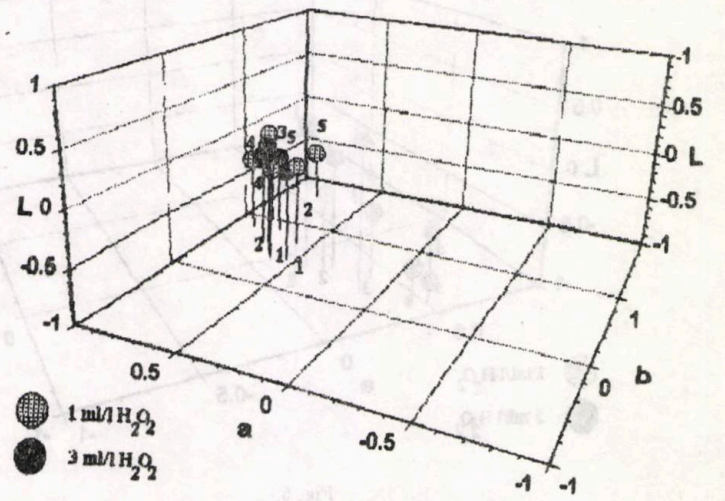

Fig. 3

The colour changes that take place when Reactive Black 8 is used (Figs.5, 6) show a shift to bigger values of the a parameter, therefore to reddish nuances, and to smaller b values, therefore to bluish nuances. This happens especially after the third recycling cycle. When we used 3 ml/l hydrogen peroxide in the discoloration phase,

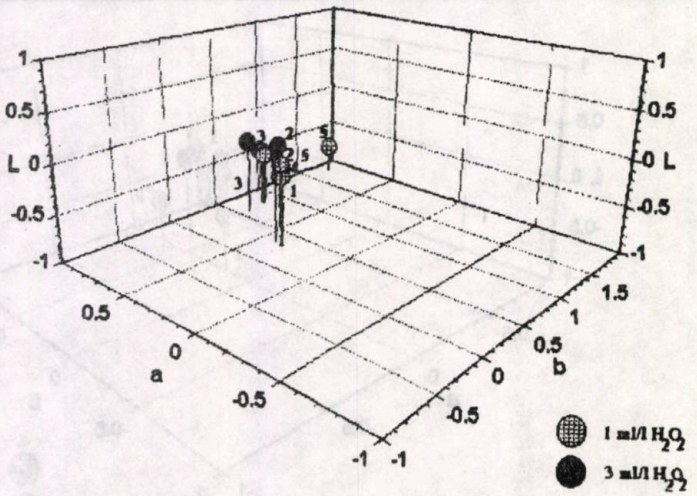

Fig. 4

the colour changes were smaller. There are changes in the lightness of the samples, especially after the third recycling cycle (in the case of the 1 ml/l peroxide hydrogen decolorisation method).

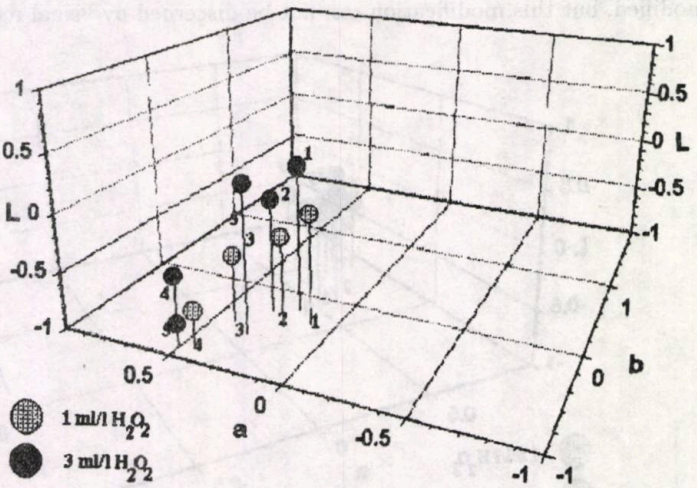

Fig. 5

In the Figs.7, 8 there are described the colour modifications that happen when the dyeing was performed with Reactive Orange 3. It can be seen that a very small shift to red takes place, especially when discoloration was made with only 1 ml/l hydrogen peroxide. The lightness decrease is moderate. This occurs mainly after the third recycling, but even in these conditions it can not be discerned by visual means.

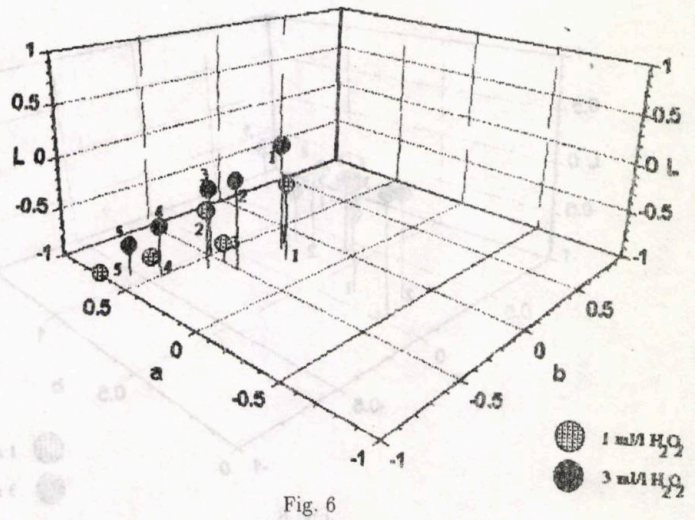

Fig. 6

For every situation that we studied, ΔE was calculated using the following relation:

$$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$$

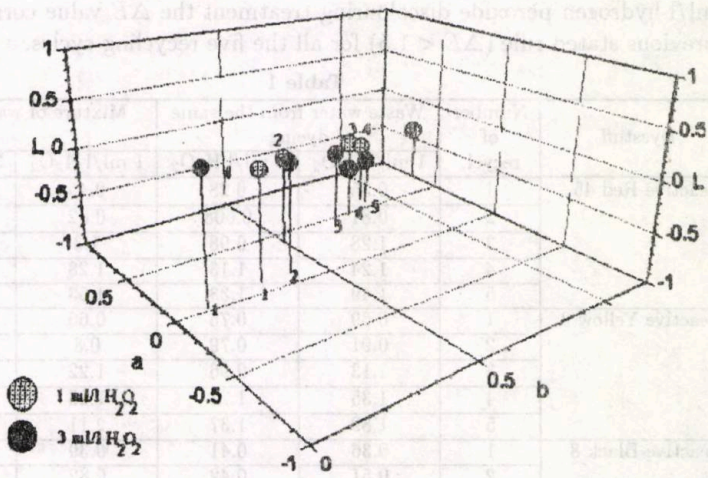

Fig. 7

The values that we obtained are showed in Table 1.

From this table it can be seen that the colour differences are up to 1.3 for the first three recycling cycles when the waste waters resulted from a single dyeing and the decolourising was performed with 1 ml/l hydrogen peroxide. When the discolouring was performed with 3 ml/l hydrogen peroxide, even after 5 recycling the colour

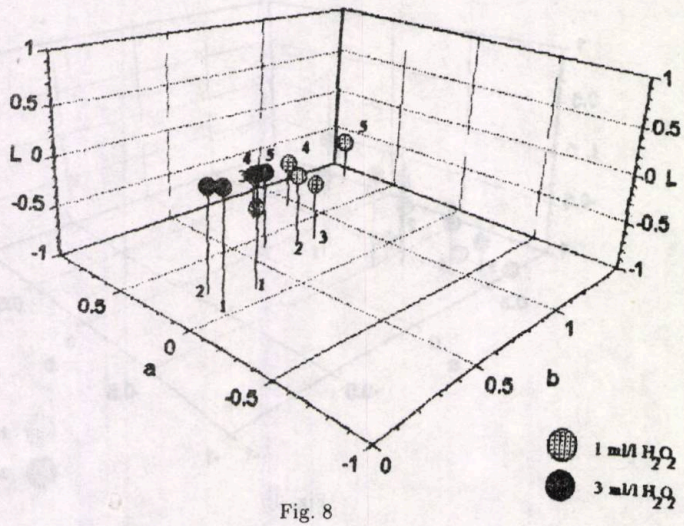

Fig. 8

difference does not exceed 1.37. Considering the big influence that the lightness has in the ΔE value, it can be appreciated that the range of values where the colour difference varies is acceptable. When a mixture of waste waters is used, the ΔE values are bigger, especially as a result of decreases in lightness. Even in this conditions at a 3 ml/l hydrogen peroxide discolouring treatment the ΔE value corresponds with the previous stated rule ($\Delta E < 1.5$) for all the five recycling cycles.

Table 1

Dyestuff	Number of recycl.	Waste water from the same dyeing		Mixture of waste waters	
		1 ml/l H_2O_2	3 ml/l H_2O_2	1 ml/l H_2O_2	3 ml/l H_2O_2
Reactive Red 45	1	0.35	0.28	0.45	0.26
	2	0.81	0.608	0.82	0.63
	3	1.28	0.98	1.3	1.12
	4	1.24	1.13	1.28	1.29
	5	1.49	1.33	1.53	1.44
Reactive Yellow 3	1	0.69	0.75	0.66	0.51
	2	0.91	0.79	0.8	0.75
	3	1.13	0.96	1.22	0.87
	4	1.35	1.21	1.26	1.21
	5	1.89	1.37	2.11	1.35
Reactive Black 8	1	0.36	0.41	0.39	0.37
	2	0.51	0.42	0.82	0.59
	3	0.75	0.73	1.02	0.78
	4	1.18	1.07	1.33	1.06
	5	1.46	1.30	1.56	1.28
Reactive Orange 3	1	0.33	0.31	0.41	0.24
	2	0.64	0.42	0.80	0.28
	3	0.96	0.69	0.94	0.78
	4	1.13	1.06	1.28	1.00
	5	1.44	1.16	1.70	1.14

3. Conclusions. The colour changes are minor, even after 5 recycling cycles. These changes are smaller when the discoloring degree of the waste waters is higher. Using 3 ml/l hydrogen peroxide the lightness of the dyed samples is better, even if, beginning with the third recycling cycle, a decrease in lightness can be observed.

When the waste waters are not mixed, the colour differencies are lesser than 1.3 for the first three recycling cycles in the case of a 1 ml/l hydrogen peroxide discolouring process and smaller then 1.37 for all the five recycling cycles in the case of a 3 ml/l hydrogen peroxide discolouring process. Because of the great influence that lightness has in the ΔE value, we assumed that $\Delta E < 1.5$ is acceptable.

When the waste waters are mixed, the colour differences are a little bigger, but even in this case ΔE is smaller then 1.5 for all the five recycling cycles.

Received, December 5, 1997

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STUDIUL DIFERENŢELOR DE CULOARE CE APAR LA RECIRCULAREA APELOR UZATE DE LA VOPSIREA CU COLORANŢI REACTIVI PRIN PROCEDEUL PAD-BATCH

(Rezumat)

Sunt studiate modificările de culoare ce apar în cazul recirculării, după o prealabilă tratare cu apă oxigenată în prezenţă de UV, a apelor uzate de la vopsirea cu coloranţi reactivi. Se studiază modul în care gradul de recirculare şi numărul de recirculări influenţează asupra diferenţelor de culoare şi se evidenţiază, prin reprezentarea culorii în spaţiul ANLAB, sensul în care deplasarea culorii are loc.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

THE FLEATTENING OF THE SPATIAL SHAPES OF THE FOOTWEAR PRODUCTS

BY

MARIANA COCEA and DAN-FLORIN CROITORU

In this paper we made studies regarding methods for flattening the spatial surfaces of the footwear products.

1. Introduction. Mathematical modelling and graphic visualisation of the shapes are a representation of the spatial objects on the computer's screen and a mathematical representation of the geometrical model made on computer.

The mathematical representation establishes the precise shape of the object, by means of cross and longitudinal interpolation curves of the shape [1], [2].

By having to possess a precise mathematical representation of an object a 3D computer assisted casting is possible.

Interactive calculus systems allow the study of modelled spatial shapes and immediate visualisation of some work hypothesis. They also allow the user to make any desired changes at the products he works on and to make different variants of products.

As a result the user obtains a better product, in a little time, with few expenses.

A 3D computer assisted casting allows the shoe makers to achieve and promote their own shoe collection in time. The collection can satisfy the shoe buyers who are interested in the products' quality, design and in fashion [3].

On the world plane CIM – complete computer integration manufacture in footwear – became a current activity. For this there were elaborated varied 3D soft systems. Some are used to cast the footwear products straight on the last, some to obtain the spatial shape of the surfaces, with the possibility of their flattening and their plane processing.

Such a system is the PADSY system. This is a developed casting system that has been elaborated by the Atom+Vicam company, from Wien. It provides the user with the most advanced functions and CAD/CAM technology for manufacturing footwear products [4].

Padsy III, which is a component of this system, allows the user to elaborate the footwear models direct on the last and to visualise in 3D the models with different colours. Thus he can obtain new and aesthetic models. In the same time the Padsy III module allows the flattening of the spatial shapes of the footwear product's sur-

faces. After flattening, the user can process them with specialised modules in 2D, named Padsy II.

2. Studies Regarding Methods of Flattening. From experimental and theoretical studies, it has been reached the conclusion that the flattening of the spatial shapes means methods of passing from a 3D system in a 2D system, keeping the shape and the calculated areas and length [4].

An algorithm for plane unfolding of spatial shapes by using the flattening method assumes the next major charges: the mathematical modelling and the graphic visualisation of a last defined through longitudinal and/or cross sections; drawing the footwear model direct on the last; obtaining the shape of the footwear model's spatial surfaces; mathematical modelling of spatial shapes, through longitudinal and/or cross sections and graphic visualisation; establishing the area of the surfaces' spatial shape and the length of their outlines; passing the interpolation longitudinal or/and cross curves, by keeping their length, from 3D co-ordinates system into 2D co-ordinates system.

3. Results. In this paper we elaborated our own algorithms for plane unfolding of spatial surfaces by using the shapes' flattening method.

In the first part of the paper we made a study by means of the computer with our own algorithm for plane unfolding of a 3D curve, keeping its shape. In Fig. 1 it can be noticed how the 3D curve has transformed in a line.

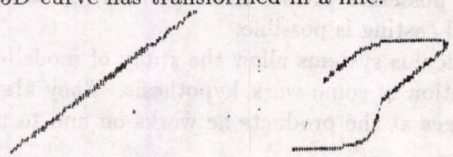

Fig. 1

In the second part of the paper we elaborated the algorithm for plane unfolding of the spatial surfaces of a footwear product, keeping its shape and the length of its outlines.

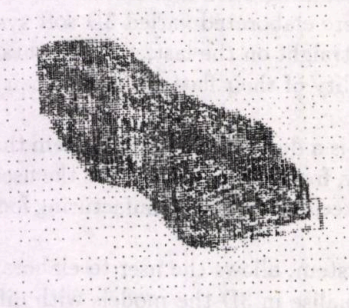

Fig. 2

Fig. 3

The elaborated algorithm includes the next basic procedures:

- the mathematical modelling and the graphic visualisation of a last defined through cross sections (Fig. 2);

- the sectioning of the last with a cross plane and a longitudinal one and obtaining the spatial shape of the top (Fig. 3);

- the calculus of the length of 3D curves that belong to the cross sections of the spatial shape of the top and their passing in a 2D system (Fig. 4);

Fig. 4

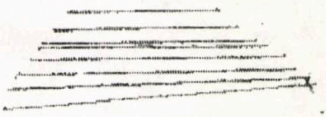

Fig. 5

- the interpolation of the co-ordinates that define the plane shape of the top, keeping the length of the outlines (Fig. 5).

4. Conclusions. The mathematical modelling of the spatial shapes means methods to obtain the numerical model with precision. The precision only depends on the characteristics of the calculus system the algorithm is implemented on. The achieved method is an important contribution in the footwear products casting activity and in promoting new products with different appearances and styles, allowing the footwear producer to keep up with the fast changes of the market economy.

Received, April 15, 1997

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APLATIZAREA FEŢELOR SPAŢIALE A PRODUSELOR DE ÎNCĂLŢAMINTE

(Rezumat)

S-au efectuat studii privind metode de desfăşurare plană a feţelor spaţiale ale produselor de încălţăminte, metode denumite aplatizarea formelor.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

DE L'ÉLABORATION DE LA BASE THÉORIQUE DE STANDARDISATION DES PRODUITS DANS L'INDUSTRIE DE CONFECTIONS

PAR
AURICA PÎCĂ

Sont présentés les aspects caractéristiques de l'activité de standardisation dans l'industrie de confections, la base théorique de celle-ci, ainsi que le système d'indicateurs pour l'évaluation de l'éfficacité de la standardisation constructivo-technologique des produits d'habillement.

1. Nécessité et opportunité de la standardisation des produits dans l'industrie de confections. Une industrie moderne de confections doit satisfaire les exigences toujours croissantes des bénéficiaires des articles d'habillement, fait qui impose la renouvellement rapide et à de courts intervalles ainsi que la diversification des produits d'habillement. Cette diversification est due aussi à l'apparition de nouveaux matériaux textiles et de nouveaux concepts dans la réalisation de projets des produits, à l'usure morale rapide de ces derniers.

Mais la diversification des produits implique la modification du processus de fabrication, les dépenses de temps, de travail humain et matérialisé qui font que les changements rapides de modèles ne soient pas avantageux du point de vue économique; d'autre part, la diversification de l'assortiment de production conduit à la réalisation d'une fabrication de petite série qui constitue un obstacle à l'introduction d'une nouvelle technique et donc à l'organisation d'une production rentable.

Il est possible de résoudre ces aspects contradictoires en utilisant les principes de standardisation des produits et éléments de produit par familles des modèles, comme une nouvelle méthode de conception des articles d'habillement, par laquelle à partir d'un nombre réduit d'éléments typisés on crée une multitude de modèles pour le même type de base de produit [1].

Elle conduit à la réalisation d'économies importantes sur les frais de création et de conception des produits, dont les plus significatives sont:

- diminution de la durée et réduction des dépenses de conception et lancement de nouveaux articles;
- création des conditions d'automatisation de l'activité de conception constructive et technologique;
- réduction de la main-d'œuvre par produit;

- valorisation supérieure des ressources matérielles, ainsi que de celles récupérables et réutilisables;
- accroissement de la productivité du travail à toutes les étapes du processus de réalisation de produits, etc.

2. Aspects spécifiques de l'activité de standardisation dans l'industrie de confections. Dans l'industrie de confections l'activité de standardisation des articles d'habillement doit être réalisée par (Fig. 1):

a) standardisation constructive;
b) standardisation technologique;
c) standardisation de l'organisation.

La standardisation sur ces trois plans se fait dans l'ordre mentionnée et en étroite correlation et interdépendance, chacun d'eux étant détaillé en fonction de la modalité d'être abordé [2], [3].

Ainsi, pour la *standardisation constructive* c'est-à-dire celle de la documentation pour la conception constructive à base duquel on fait unifier les constructions par catégories de produit, types de base de produit et éléments de produit, on effectue une analyse complexe de la multitude de produits d'habillement, sous divers aspects, dans un ordre établi:

- analyse fonctionnelle du produit qui permet de préciser la classe de produit, par rapport à la fonction principale remplie par le produit (vêtements usuels, de travail, de protection, de sport);
- analyse du produit du point de vue de la surface d'appui sur le corps, qui délimite cette catégorie de produit dans le cadre de la classe (vêtements s'appuyant sur les épaules, avec appui à la taille, respectivement le segment de corps recouvert);
- analyse morpho-fonctionnelle du produit qui permet de définir le type de base de produit (celui qui assure, d'une certaine manière, le recouvrement du corps, total ou partiel);
- analyse de la ressemblance constructivo-technologique, qui contribue au groupement de produits d'un type de base en une famille de modèles;
- analyse des particularités constructivo-décoratives qui met en évidence le modèle, appartenant à une famille de modèles;
- analyse structurale du produit qui conduit à la définition des éléments du produit, en mettant en évidence la complexité physique aussi bien du produit que la modalité de reconstruire le produit.

Ces analyses reposent sur le fait que, pour les articles d'habillement ainsi que pour les éléments de produit, il y a une série de critères, en fonction desquels, ceux-ci peuvent être groupés allant jusqu'au niveau de famille, ou aura lieu la standardisation constructive.

La *standardisation technologique*, qui est réalisée en étroite interdépendance avec la standardisation constuctive, consiste à élaborer de microprocessus technologiques

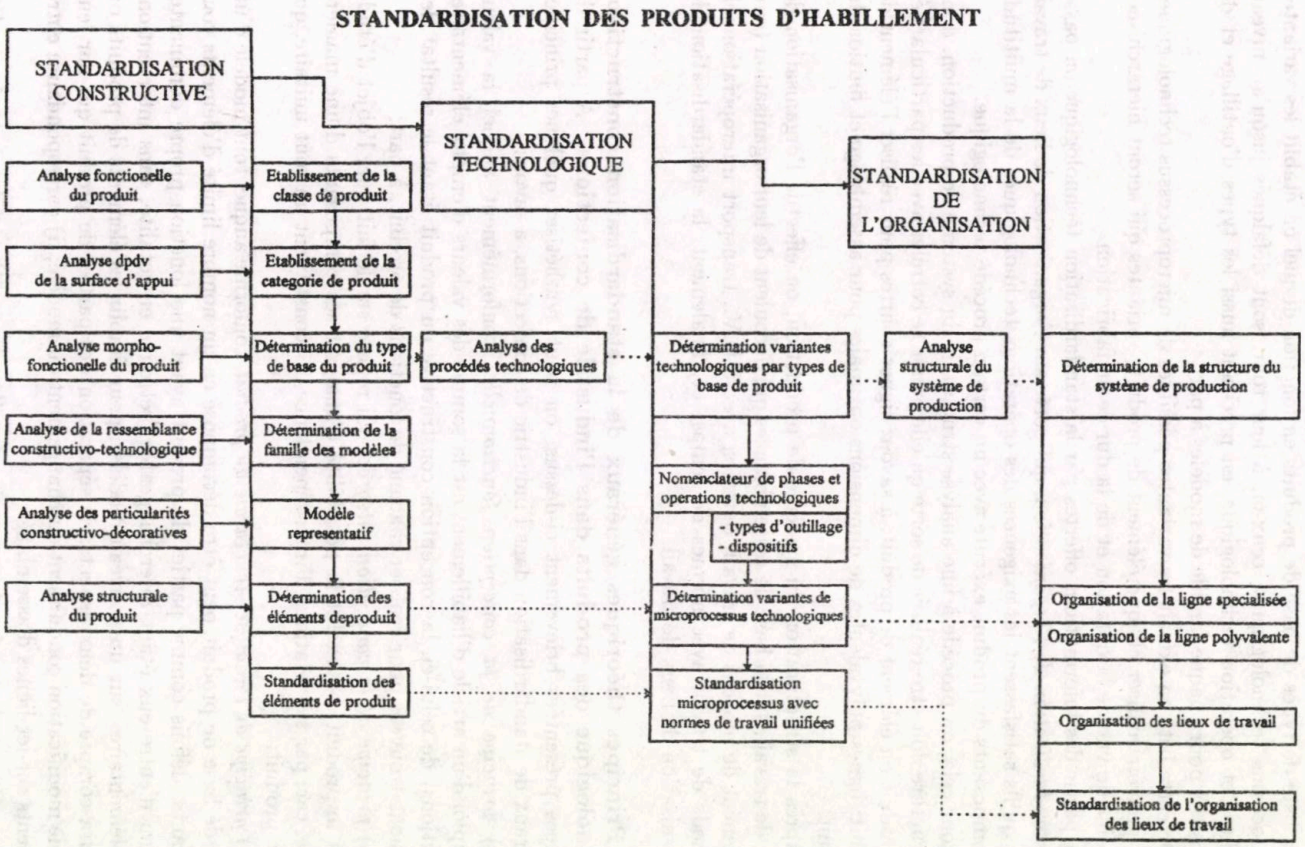

Fig. 1.– Structure de l'activité de standardisation dans l'industrie de confections.

avec normes de temps unifiées pour chaque élément de produit typisé. Elle est basée sur la liste de types de base de produits en fonction duquel on établit les variantes de processus technologiques; ceux-ci, à leur tour, sont défalqués jusqu'au niveau de phase et opération technologique, en précisant aussi les types d'outillage et de dispositifs pour chaque famille de modèles à part.

De cette liste on extrait les variantes possibles de microprocessus technologiques pour pouvoir réaliser chaque élément de produit, variantes qui seront hierarchisées du point de vue de la dotation et de la dur ée de fabrication.

A partir des informations offertes par la standardisation technologique on passe à la *standardisation de l'organisation*, qui porte sur l'organisation de lieux de travail pour qu'ils satisfassent les exigences des opérations technologiques de la multitude de composants du produit exécuté avec un certain procédé technologique.

Pour cela, on procéde à une analyse structurale du système de production, dont la structure doit être réalisée de sorte qu'elle puisse se corréler avec les particularités du produit on élément de produit, à savoir: lignes courtes pour réaliser l'élément de produit; lignes polyvalentes de dimensions optimales pour assemblage et finition du produit.

Après la structuration du système de production, on effectue l'organisation de lieux de travail, sur la base de ressemblances qui découlent de leur organisation (emplacement de moyens de travail, dotation avec S.D.V., transport interopérationnel, méthode de travail avec normes de temps) et, finalement, la standardisation de l'organisation de lieux de travail.

3. Principes théoriques généraux de la standardisation constructivo-technologique des produits dans l'industrie de confections. A partir de données présentées brièvement ci-dessus, on peut synthétiser quelques principes généraux de standardisation dans l'industrie de confections, à savoir:

a) *principe de la conception fonctionnelle*, conformément auquel la valeur d'emploi d'un article d'habillement est la somme des valeurs d'emploi élémentaires (fonctions) de celui-ci, la conception constructive du produit étant le résultat des solutions trouvées pour réaliser chacune de fonctions de produit, à part;

b) *principe de la conception intégrée*, qui repose sur le fait que, l'objet d'étude étant le produit, on exclut la possibilité d'analyser ses composants d'une manière isolée, car, par ses relations d'interdépendance, ils constituent un tout unitaire, qui est le produit;

c) *principe de l'analyse structurale du produit*, conforme auquel tout modèle d'un type de base de produit peut être décomposé en un nombre limité d'éléments constituants, définis comme parties de produit ayant une fonction propre dominante, chacun d'entre eux étant interchangeable (retrouvé en totalité, sans interventions supplémentaires, sur un nouveau modèle); pour établir les éléments de produits on tiendra compte de deux aspects: i) séparation des parties de produit qui par leur simple modification conduissent au changement du modèle; ii) correspondance entre éléments sur les lignes d'assemblage;

d) *principe de la structuration des familles de modèles et le choix du modèle*

représentatif, conforme auquel les composants du produit se constituent en familles sur des critères de ressemblance fonctionnelle, morphologique et technologique, la standardisation étant réalisée dans le cadre de la famille de modèles; chaque famille est définie par un modèle représentatif, exprimé soit par un produit naturel (existant dans la famille), soit par un produit conventionnel;

Tableau 1

Système d'indicateurs et d'indices d'évaluation de l'efficacité de la standardisation constructivo-technologique des produits d'habillement

No.	Indicateur/Indice	Relation de calcul	Signification de termes
1	Degré de réutilisation des composants typisés	$G_r = \frac{C_r}{C_n+C_r} \cdot 100$	C_r – no.composants réutilisés dans le nouveau modèle C_n – no.composants nouvellement introduits
2	Degré de standardisation constructive du modèle	$G_{tc} = (C_t/C) \cdot 100$	C_t – no.composants typisés de la structure du modèle C – no.total composants de la structure du modèle
3	Degré de standardisation technologique du modèle	$G_{tt} = (M_t/M) \cdot 100$	M_t – no.microprocessus typisés M – no.total microprocessus nécessaires pour l'exécution du modèle
4	Économie du temps de travail dans la conception constructivo-technologique	$E_{tm} = t_{nl} - t_{no}$	t_{nl} – temps d'élaboration de la documentation de lancement du produit avec éléments typisés t_{no} – temps d'élaboration de la documentation de lancement du produit avec éléments non-typisés
5	Accroissement prévisible de la production	$I_{\Delta Q_{pr}} = (Q_{pr}/Q) \cdot 100$	Q_{pr} – niveau calculé d'avance de la production dans les conditions de standardisation Q – niveau de la production sans standard.
6	Accroissement prévisible de la productivité du travail	$\Delta W_{pr} = W_{pr} - W_0$ $\Delta W_{pr} = Q_{pr}/T_{nl} - Q_0/T_{no}$	W_{pr} – niveau calculé d'avance de la productivité dans des conditions de standardisation W_0 – niveau calculé d'avance de la productivité sans standardisation T_{nl} – temps de réalisation du modèle par des méthodes de travail typisées T_{no} – temps de réalisation du modèle par des méthodes de travail non-typisées

e) *principe d'évaluation de l'efficience de la standardisation constructivo-technologique*, par lequel l'efficacité de la standardisation est définie par un système d'indicateurs et indices (Tableau 1): degré de réutilisation de composants typisés (G_r); degré de standardisation constructive des modèles (G_{tc}); degré de standardisation technologique des modèles (G_{tt}); économie de temps de travail dans la conception constructivo-technologique (E_{tm}); accroissement prévisible de la production ($I_{\Delta Q_{pr}}$); accroissement prévisible de la productivité du travail (ΔW_{pr}).

Reçue le 25 jouillet 1997

Université Technique „Gh.Asachi", Jassy,
Chaire de Management

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DESPRE STABILIREA BAZEI TEORETICE A TIPIZĂRII PRODUSELOR ÎN INDUSTRIA DE CONFECŢII

(Rezumat)

Sunt prezentate specificităţile activităţii de tipizare în industria de confecţii, principiile teoretice generale şi un sistem de indicatori de evaluare a eficienţei tipizării constructiv-tehnologice a produselor de îmbrăcăminte.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1–2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

TOWARDS A MODEL OF TECHNOLOGY TRANSFER

BY
CARMEN-AIDA HUŢU

Technology represents one of the key factors for the development and success of the Romanian companies in a global economy. In this context, technology and organization change in order to gain competitive advantages must become one of the main priorities of the Romanian economy. Accepting the philosophy that the technology is a complement, not a substitute for humans leads to complex approaches of balancing, mediating and aligning the human and technological systems within organizations where boundaries become more and more permeable to *technology and information transfer* as a critical factor for survival and success. The paper proposes a new model for technology transfer, based on communication and mediating institutions, which offers a holistic perspective on the phenomenon and a systematic and comprehensive frame of reference for further research and real-life projects.

1. Introduction. Technology represents one of the critical driving forces of a company's growth and development. Information technology, robotics, automation, CIM, CAD, CAM, AMT, etc. are only some of the key words in nowadays breakthrough technologies and key factors in creating competitive advantages.

But technology by itself is neutral: it doesn't represent anything. It gains meaning only when integrated into organizations. The effects of technology on Organizations – *technological determinism* [1] – are reflected in the way they are organized: organization structure; the decision making process; the levels of education and training; the characteristics of the communication process; the standards of performance, etc. Considering that, technological (through advanced technologies) as well as organizational change, promoted in purpose to fulfil and even surpass customers' needs and wants and to create new competitive spaces, has lately become the dominant preoccupation of companies worldwide.

The hottest issue here is not concerned with the benefits of high-tech, but it's impact on organizations. It's not an issue regarding the technology itself, but a complex of managerial problems concerning implementation, such as: work oversimplification affecting social relationships through isolation and alienation; low levels of workers' involvement determined by high levels of task standardization; negative psychological effects due to computerized performance monitoring; worker obsolescence; information overload, etc.

The paradigm shift from the mindset that technology is good in any circumstances to the conecpt that technology is good only if it is adequately used led to the creation of methods, techniques, or even applied sciences (i.e.: Industrial Engi-

neering, Sociotechnical Systems, Human Factors Engineering, Quality of Work Life, etc.) in order to effectively integrate technology with organizations.

Accepting that technology is complementing humans, not competing with them, determined important efforts for balancing, mediating and aligning the technological and social systems of organizations. The direct access to information, consistent and honest communication, employees' involvement and participation to the decision making process, planning and implementation of the new technologies, continuous education and training are only some of the most important management tools which facilitate effective integration and use of those technologies.

The principle that technology is complementing humans, not replacing them, is the guiding light the author of this paper followed in an attempt to integrate the more general concepts of equilibrium and systemic approach which recognize the importance of all elements and relationships to the survival and success of the whole.

"...integrating new ideas into the commercial economy" [2] is one of the main traits of the global econolmy of the information era. The organizational boundaries more and more permeable in order to facilitate the transfer of information and technologies, and the quality and speed of the integration of new technologies become crucial for survival and success.

Reflecting these realities, technology transfer is a complex and vital phenomenon of the economy today, defined as [3]:

- the iterative movement of applied knowledge through one or more communication channels representing pairs of agents (sources, destinations) structured as groups or organizations;
- the communication of organized knowledge in order to create new or impoved products, processes and services;
- the process of inter-organizational integration of science with management objectives; etc.

Examining the various definitions of technology transfer, there is possible to identify some key common elements:

- the technology transfer is a *communication process* which implies transmission of organized knowledge, associated or not with material elements, between a source/sender (the supplier/owner of technology) and a receiver;
- the technology transfer implies a process of integration and adaptation of a system (the technology), created and developed in a certain context, to another context;
- the technology transfer is based on creativity and innovation; not only is this a characteristic of the R&D structures which generate the tachnology, but also is a critical issue during the large scale change processes undergone by the recipient organizations in order to achieve their goals and objectives.

Forthemore, reviewing several of the most recognized models of technology transfer [4],...,[10], there can be pointed out several key elements for the understanding of the phenomenon as prerequisites for the conceptualization of the new model:

- the technology transfer is, above all, a process of communication, fact underlined by all the models examined; what is not explicitly emphasized by all the authors

is the cybernetic character of the process (Cojocaru, 1991), implying feedback during the dialogue between the receiver and the source; it is worthwhile to mention the importance of two-way communication, even though the main information, knowledge (know-how) and material (machinery and equipment) flow is directed from the source to the receiver;

• all the models accept, explicitly, the influence of conceptual, contextual, and percentual differences between the source and the receiver, and the various perturbations which intervene during the process as barriers to effectve technology transfer; in order to diminish/eliminate these perturbations and barriers, there are specific responsibilities required for the sender and the receiver; because, in most of the cases, there are resource limitations (there is necessary to have a broad view on the meaning of resources, from information and knowledge to material and financial resources) and areas of interest which may go beyond the level of the two entities transferring the technology, the intervention of mediating institutions (consulting companies, government agencies, focus groups and steering committees gathering experts from the two companies, etc.) becomes necessary in order to facilitate the process;

• the role of the mediating institutions is to work towards the enlargement of the common field of experience and expectations of the source and the receiver through dialogue and common understanding because the effectiveness of technology transfer cannot be limited to the receiver's attempt to use the technology, but aims at the integration of the new technology within the receiver organization through a continuous process of innovation which must fit the requirements of the company's goals and objectives; depending on the context, the scope, the quality and the speed the common field of experience and expectations is enlarged and the degree of resource limitation, the intervention of the mediating institutions may be extended to the whole process or may be limited to key issues which temporary surpass the knowledge, skills and abilities of the main parteners (the source and the receiver); not only is the elimination of the mediators during the late stages of technology transfer beneficial from an economic point of view, but also it demonstrates the maturation of the communication process and growing mutual understanding;

• finally, an important conceptual role is played by the paradigm shift concerning the source and receiver's positioning in the sequence of technology transfer; pinpointing the demand side, in other words the receiver's technological needs, it builds the foundations for further developments regarding both the (re)structing and the evolution of the receiver organization during the process of technology transfer, and the orientation and strategic planning of the C&D and innovation processes of the sender organization.

Based on these findings, the author created a new model of technology transfer (Fig.1) which considers this complex phenomenon from both economic and human points of view.

Pointing out the critical role of the receiver's technological needs for the overall evolution of the technology transfer, the model underlines the strategic importance of the new technology in order to create competitive advantages and added value in

relation with target markets (maintaining and developing the existing ones and/or building new ones). The acquisition of new technologies in order to develop products that fulfill and even surpass customers' needs and wants is part of the complex process of creation of "core competencies" [11] (a unique combination of resources, "tangible and intangible assets" [12], know-how, etc.) as main source of competitive advantages in nowadays economic environment. From this point of view, technology transfer must be considered as a *dynamic* process: a continuous transaction and two-way communication process in purpose to creatively adapt and develop the new technology within the receiver organization accordingly to the market demands.

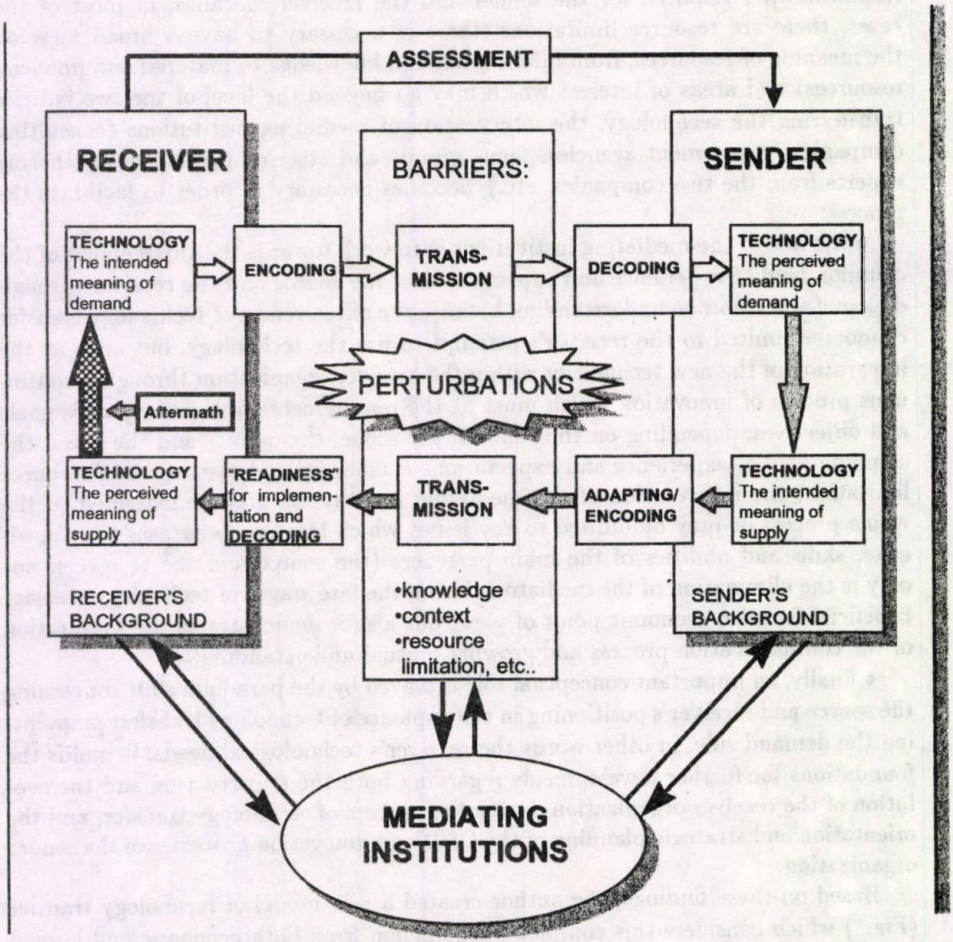

Fig. 1.– A technology transfer model based on communicarion and mediating institutions.

Regarding the human aspects of technology transfer, the model underlines (besides the inherent perturbations) the barriers – knowledge, conceptual, cultural, etc. – between the two entities transactioning the technology. Two aspects are critical in

order to diminish the impact of these barriers:

- the way the sender adapts/"encodes" the technology to fit the receiver's needs;
- the way the receiver adapts its own organization accordingly to the needs of "decoding"/implementation of the new technology and its own goals and objectives.

These approaches are extremely difficult considering the numerous complexity and uncertainty factors related to the technology transfer process which are going beyond the knowledge differences between the two entities. The individual, group, structural and cultural factors, specific to each organization, are combined with economic, technological, competition, legal, political and cultural factors of their external environment. Obviously, the higher the contextual difference between the two entities (i.e.: the international technology transfer, targeted by the Romanian companies), the more difficult the technology transfer will be.

In order to facilitate the communication between the two companies transferring the tecnology and to higher the speed of absorption and acceptance of the new technology at the receiver organization, the model specifically addresses the issue of the mediating institutions. These structures may be governmental (so, accordingly to their purpose, their interventions, direct or indirect, are inherent), or nongovernmental entities. The later may be consulting groups or firms hired by the main participants in accordance with their perceived needs and available resources, or may be created by the two parties through special and coherent programs and structures – such as focus groups, steering committees, cross-functional teams, etc. – in purpose to exclusively facilitate the technology transfer.

Last but not least, the continuous evaluation process must be pointed out. It has the key role of monitoring the technology transfer and adjusting the whole approach in order to maintain the targeted standards of performance.

The author believes that this attempt of creating a new model for technology transfer brings a holistic vision of the phenomenon and offers a systematic and comprehensive frame of reference for further research and real life projects.

Received, May 5, 1997

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MODEL DE TRANSFER TEHNOLOGIC

(Rezumat)

Tehnologia reprezintă unul dintre factorii cheie pentru dezvoltarea, succesul şi viabilitatea companiilor româneşti în cadrul economiei globale. În acest context, schimbarea tehnologică şi organizaţională în scopul creării de avantaje competitive trebuie să devină o preocupare dominantă pentru economia românească în vederea alinierii la cerinţele pieţei globale. Acceptarea filosofiei că tehnologia complementează, nu concurează demersurile umane, conduce la manifestarea unor eforturi susţinute de echilibrare, mediere şi aliniere a sistemelor tehnologice şi umane în cadrul unor organizaţii a căror grtaniţe devin din ce în ce mai permeabile la *transferul de informaţie şi tehnologie* ca element critic pentru supravieţuire şi succes. Într-un domeniu în care există o mare varietate de definiţii, concepte şi modele, lucrarea de faţă propune un nou model pentru transferul de tehnologie, bazat pe comunicare şi instituţii de mediere, care să ofere o viziune holistică asupra fenomenului şi un cadru de referinţă sistematic şi comprehensiv pentru cercetări ulterioare şi proiecte aplicative.

BULETINUL INSTITUTULUI POLITEHNIC DIN IAŞI
Tomul XLIV (XLVIII), Fasc. 1-2, 1998
Secţia VIII
TEXTILE. PIELĂRIE

RECENZII BOOK REVIEWS

VINCENTI R., *Elsevier's Textile Dictionary.* Elsevier Science, Amsterdam, 1993, 632 pp., ISBN 0-444-88709-1.

The aim of this dictionary is to provide an up-to-date reference book which, by including the most recent developments in the textile field generally, fills the gap left by far larger but outdated works. An effort has been made to keep the number of terms limited to those actually required for technical purposes. The emphasis is therefore on specialized terms with a minimum of general ones which have been included only because they recur frequently in textile translations. The terms have been selected over the years from "live" sources, i.e. manuals and catalogues of textile machinery manufacturers, international publications in several languages, standards, patents, and so on. Textile operators have also been consulted. These terms have been updated to the time of going into print.

The following subject areas are covered: textile machinery and equipment; textile fibres and goods; textile operations and processes; textile chemicals and tests; sewing, knitting and embroidery; making-up, fashion and accessories; colours and patterns; business and trade. The resulting dictionary is comparatively compact so the reader can find entries specific to the field easily and without loss of time – the volume is therefore a truly practical translator's guide.

WEISS H., *Deutsch Verständlish Aufbereitet für Schule und Beruf.* Expert Verlag, Renningen, 1996, 307 S., ISBN 3-8169-1283-4.

In diesem Buch werden sowohl die Rechtschreibung von A-Z als auch der Satzbaum die Zeichensetzung und das Formulieren verschiedener Sachschreiben ausführlich behandelt. Dabei hat der Autor bewußt auf den Gebrauch von Fremdwörtern verzichtet.

Sprachliche Inhalte werden somit Erwachsenen, die sich in Scgulungseinrichtungen, aber auch im stillen Kämmerlein beruflich qualifizieren wollen oder gar müssen, anschaulich mit Bespielen aus dem beruflichen Alltag vermittelt.

Anregungen der Dudenredaktion, die Rechtschreibung zu vereinfachen, werden beim Studium dieses Buches als vernünftig erkannt und würden bei einer Rechtschreibreform nicht zur Verwirrung führen.

KAISER A., *Schwierige Gespräche – kein Problem.* Expert Verlag, Renningen, 1996, 137 S., ISBN 3-8169-1326-1.

Gerade in wirtschaftlich schwierigen Zeiten sind Vorgesetzte in ihrem Gesprächsverhalten verstärkt gefordert. Geht es doch um die Umsetzung betriebswirtschaftlich notwendiger Maßnahmen, die im Gespräch mit den Mitarbeitern vereinbart werden müssen: Umstrukturierung, Kostenreduktion, Wechselnde Kundenwünsche, Versetzung, Innovative Zwänge, Abstimmungen mit ganzen Teams, Zurücknehmen von Perspektiven, Veränderung überholter Einstellungen und liebgewordener Gewohnheiten. Dabei sollen Motivations- und Identifikationsverluste vermieden werden.

Das Buch zeigt Ihnen auf, wie Sie schwierigen Situationen vorbeugen können, und gibt Hilfe bei Gesprächen mit kritischen und anspruchsvollen Mitarbeitern. Mit dem richtigen strategischen Konzept läßt sich eine für den Betrieb, den Vorgesetzen und den Mitarbeiter zufriedenstellende Lösung erarbeiten und eine tragfähige Beziehung schaffen. Der Leser erfährt auch, was zu tun ist, wenn diese Mittel ausgereizt sind.

Klare Anleitungen und Fallbeispiele vermitteln Anregungen, auch unter schwierigen Bedingungen Betriebsziele zu optimieren, der eigenen Verantwortung gerecht zu werden und für den legitimen eigenen Nutzen zu sorgen.

I n h a l t: Ursachen und Auswirkungen ineffizienter Gespräche – Grundprämissen der Zusammenarbeit – Problemprophylaxe – Betroffenheit bewältigen – Unterschwelliges ineffizientes Verhalten – Strategie des Gespräschserfolgs – Problemlösungssystematik – Kooperative Gesprächsmethoden – Manipulation oder Vereinbarung – Beziehungen schaffen – Motivationsorientierte Überzeugungsmethoden – Kreativität und Konsens – Umgang mit Wertekonflikten.

Die Interessenten:

– Fürungskräfte aller Bereiche, die Probleme zuversichtlicher und effizienter anpacken wollen;

– Projektleiter, -mitglieder und Fachkräfte, die mit Teams und personellen Schnittstellen umgehen müssen;

– Nachwuchsführungskräfte, die sich im betrieblichen Netzwerk behaupten wollen;

– Leiter von Arbeitsgruppen, die mit ihren Kollegen konkrete Ergebnisse vorzeigen müssen;

– Angehörige von Sozialberufen, die den Menschen bei ihrer Problembewältigung helfen wollen.

Data apariţiei: octombrie 1998, Comanda: 209
Coli tipar: 8, Tiraj: 225 exemplare

Str. Lascăr Catargi Nr. 38

ISSN 0253-1119